

20200401 - April's Specifications Committee Meeting

April Specifications Committee Meeting Agenda

Meeting Date

Wednesday, April 1, 2020 @ 9:00am

Skype Meeting. E-mail distribution message includes instruction

Approved Permanent Specification changes from last Committee meeting (2/5/20)

- **688.2.2.2-Blasting, 688.3.4-Painting Sequence, & 688.5.6-Paint Sequence** Allows cleaning to be performed with NACE equivalent.
- **108.3.1-General and 108.3.3.2-Resource Loaded Schedule** Adds Alternative Project Delivery language to the specifications
- **Pavement Markings, 663.3.8-Arrows** Adds roundabout arrows to spec book

Approved Project Specific Special Provisions (SP) from last Committee meeting (2/5/20)

- **SP615-Pack Rust Repair**
- **SP105-Alternative Project Delivery Contract**

Items removed from Committee Agenda

- **Three Project Specific Special Provision (SP) for Railroad - SP900, SP212, and SP639**

Old Business - Provisions discussed at last Committee meeting

615	615.6.9-Final Cleaning of Weathering Steel Bridges	<p>4th time to Committee; discussed in October, December, & February.</p> <p>Proposed specification change to Section 615. It updates the cleanliness requirements.</p> <p>Specification has been updated per comments at the last meeting, it is redline copy showing the proposed changes/updates to the spec.</p>
219	219.5-Method of Measurement	<p>3rd time to committee; discussed in December & February.</p> <p>Proposed specification change to Section 219. The update adds Method of Measurement subsection to the specification.</p> <p>Specification has been updated per comments at the last meeting.</p>
642	SP642-Skimmer	<p>4th time to committee; discussed in April, June, & August</p> <p>Project Specific Special Provision (SP) for temporary sediment basin floating skimmer.</p> <p>The SP has been updated per comments at the last meeting. A redline copy, showing the proposed changes from the last meeting is included.</p> <p>Approval is expected in April</p>

108	SP108-Winter Working Liquated Damages	<p>This is an update to previously approved SP. 2nd time to committee; discussed in February.</p> <p>Special Provision to allow liquidated damages during winter months. The revision adds reference to Table 108.7.1 and allows weather days.</p> <p>No update to the SP. A redline copy, showing the proposed changes from the last meeting is included.</p> <p>Approval is expected in April</p>
601	601.3.1-Mix Design Requirements	<p>2nd time to committee; discussed in February.</p> <p>Proposed specification change to Section 601. The update is to correct formatting of entrained air column in Table 601.3.1A, there are no changes to the language in the provision.</p> <p>No update to the specification, it is redline copy showing the proposed changes/updates to the spec.</p> <p>Approval is expected in April</p>
604	604.8.1-Initial Backfill Material	<p>2nd time to committee; discussed in February.</p> <p>Proposed specification change to Section 604. It allows use of Class B concrete instead of CLSM for Type F trench backfill.</p> <p>No update to the specification, it is redline copy showing the proposed changes/updates to the spec.</p> <p>Approval is expected in April</p>
625	Section 625-Rock Socketed Drilled Shaft	<p>2nd time to committee; discussed in February.</p> <p>Proposed specification change to Section 625. It is a complete section rewrite.</p> <p>Specification has been updated per comments at the last meeting, it is redline copy showing the proposed changes from the last meeting is included.</p>
625	SP625 - Test Shafts	<p>2nd time to committee; discussed in February.</p> <p>Special Provision to test shaft.</p> <p>No updated to the SP.</p>
636	636.24-Basis of Payment	<p>2nd time to committee; discussed in February.</p> <p>Proposed specification change to Section 636. The update adds payment instruction of lump sum "Temporary Structure for Maintaining Traffic".</p> <p>Specification has been updated per comments at the last meeting, it is redline copy showing the proposed changes/updates to the spec.</p>

641	SP641 – Mitigation Devices	<p>2nd time to committee; discussed in February. Special Provision to test shaft.</p> <p>The SP has been updated per comments at the last meeting. A redline copy, showing the proposed changes from the last meeting is included.</p> <p>Approval is expected in April</p>
642	SP642-Compost Sock	<p>2nd time to committee; discussed in February. Special Provision to compost sock.</p> <p>The SP has been updated per comments at the last meeting. A redline copy, showing the proposed changes from the last meeting is included.</p>
602	602.2-Materials & 602.11-Pay Items	<p>1st time to committee. Proposed specification change to Section 602. It removed invalid reference and adds stainless steel and low chromium steel reinforcing steel references and pay item.</p>
709	709.1-Steel Bars for Concrete Reinforcement	<p>2nd time to committee; discussed in February. Proposed specification change to Section 709. It adds subsection for stainless steel and low carbon steel.</p>
709	709.15-Coated Dowel Bars & Dowel Basket Assemblies	<p>1st time to committee. Proposed specification change to Section 709. It removed invalid reference from subsection.</p>
715	715.4-Concrete Repair Materials	<p>2nd time to committee; discussed in February. Proposed specification change to Section 715. It updates the test methods of concrete patching materials.</p> <p>No update to the specification.</p>
627	SP627-Modular Expansion Joint	<p>2nd time to committee; discussed in February. Special Provision for modular expansion joint.</p> <p>No updated to the SP.</p>

New Business - New Provisions for Spec Committee

SECTION	TITLE	DESCRIPTION
203	203.1-Description	<p>1st time to Committee. Proposed specification change to Section 203. WVDOT Maintenance Division is now called Operations Division and revision is to update this.</p> <p>A redline copy, showing the proposed changes/updates to specification is included.</p>

506	506.4-Testing	<p>1st time to Committee. Proposed specification change to Section 506. It requires 'match-cure' box for concrete cylinders that must attain 'open to traffic' strength in less than 8 hours.</p> <p>A redline copy, showing the proposed changes/updates to specification is included.</p>
601	601.4.2-Contractor's Quality Control	<p>1st time to Committee. Proposed specification change to Section 601. It adds reference to MP 601.03.50.</p> <p>A redline copy, showing the proposed changes/updates to specification is included.</p>
601	601.7-Mixing	<p>1st time to Committee. Proposed specification change to Section 601. The update is to clarify the job site additions of water and super-p.</p> <p>A redline copy, showing the proposed changes/updates to specification is included.</p>
601	601.12.1-Curing Under Normal Conditions	<p>1st time to Committee. Proposed specification change to Section 601. It prohibits adding extra cement in large concrete elements to avoid thermal cracking.</p> <p>A redline copy, showing the proposed changes/updates to specification is included.</p>
601	SP601 -Surface Resistivity	<p>1st time to Committee. Special Provision for Surface Resistivity testing.</p>
601	601.3.1.1-Mix Design Using Potentially Reactive Aggregate	<p>1st time to Committee. Three specification changes related to Alkali-Silica Reaction (ASR)</p> <ol style="list-style-type: none"> 1. Proposed specification change to Section 601. Adding subsection 601.3.1.1 for mix design using ASR. 2. Proposed specification change to Section 501. Aggregate with applicable reactivity reference 601.3.1.1 subsection. 3. Proposed specification change to Section 603. Adds reference to 601.3.1.1 subsection.
501	501.3-Propportioning	
603	603.6.2-Mix Design:	
604	604.12-Inspection and Acceptance	<p>1st time to Committee. Proposed specification change to Section 604. It further defines the rigid & flexible pipe criteria. And testing of the pipe.</p> <p>A redline copy, showing the proposed changes/updates to specification is included.</p>
613	SP613-Spray Applied and Spin-Cast Pipe Lining	<p>1st time to Committee. Special Provision for repair and rehabilitation culverts by spray applied and spin-cast pipe lining.</p>

663	SP663-Type S Marker	1st time to Committee. Special Provision for Type S slotted marker.
707	707.4-Supplementary Cementitious Materials (Scms) for use in Portland Cement Concrete	1st time to Committee. Proposed specification change to Section 707. It adds reference to MP 707.04.10 and requires fly ash meet requirements of ASTM C618. A redline copy, showing the proposed changes/updates to specification is included.
715	715.11.2-Acceptance	1st time to Committee. Proposed specification change to Section 715. It adds NTPEP testing requirements to the geotextile - engineering fabric A redline copy, showing the proposed changes/updates to specification is included.
720	720.5.4-Schedule 3 NHS Pavement Projects	1st time to Committee. Proposed specification change to Section 720. It updates the table of schedule 3 NHS Pavement Projects. A redline copy, showing the proposed changes/updates to specification is included.
Update: Items below added to meeting agenda		
615	SP615 - Miscellaneous Bridge Work	1st time to Committee. Two Special Provisions for Wheeling Suspension Bridge 1. SP615 - Miscellaneous Bridge Work is for thirty-four bridge repair items 2. SP688 - Field Painting is for coating of various bridge surfaces
688	SP688 - Field Painting of Metal Structures	

Comments

Comments are requested on these Specification Changes and Project Specific Special Provisions. Please share your comments by March 30, 2020, they help in the decision making process.

Please Send Comments to: DOHSpecifications@wv.gov

Deadline for new items & updates to these provisions is May 8, 2020

If you are the 'champion' of any specification changes and/or project specific special provisions currently in the Specification Committee, it is your responsibility to edit/update/modify them in a timely manner per comments and discussion in Spec Committee. *Failure to submit updates may result in removal of item and/or delays.*

Next Meeting

Wednesday, June 3, 2020 at 9am

Building 5, Room 855: *(If Available. If not available a change in venue will be attached on the door)*

2017 Standard Specifications Roads and Bridges & 2020 Supplemental Specifications

Electronic Copy (pdf): The 2017 Standard Specifications Roads and Bridges & 2020 Supplemental Specifications can be viewed, printed, or downloaded from the Specifications Website. A link to the Specifications pages is here: <http://transportation.wv.gov/highways/contractadmin/specifications>

Print Version: Hard copies of the 2017 Standard Specifications Roads and Bridges & 2020 Supplemental Specifications are available thru Contract Administration. An order form for the book is on Specifications Website. A link to the pages is here: <http://transportation.wv.gov/highways/contractadmin/specifications>

2020 Specifications Committee

The Specification Committee typically meet every other month; on the first Wednesday. 2020 meetings will be held in February (2/5), April (4/1), June (6/3), August (8/5), October (10/7), and December (12/2).

Calendar subject to change, updates will be given, as needed.

Specifications Committee Website

A copy of the meeting agenda can be found on the Specifications Committee Website <http://transportation.wv.gov/highways/contractadmin/specifications/SpecComit>

Material Procedures

Material Procedures (MPs) referenced in provisions are available upon request.

For questions regarding the Standard Specifications Roads and Bridges, Supplemental Specifications, Project Specific Special Provisions, or the Specifications Committee please e-mail DOHSpecifications@wv.gov

File Format Structure and Progression of items thru Specifications Committee

The purpose of the below protocol is to provide guidance on the file structure of Proposed Specification & Project Specific Special Provision as they progress thru Specification Committee. This procedure would facilitate a means of tracking changes from meeting to meeting; as the agendas & provisions are posted publicly online on the Spec Committee website.

TYPES OF PROVISIONS:

There are three standard types of provisions typically discussed in committee:

1. Specification Changes – These are permanent changes to the WVDOT Standard Specifications.
 - Unless inserted into a project proposal, these changes typically go into effect in January (of subsequent year) with the Supplemental Specifications.
2. Project Specific Special Provisions (SP) – Are applied to specifically designated projects.
3. Updates to previously approved SP – Changes/edits/updated to SP that have been approved by spec committee.

NEW BUSINESS ITEMS:

New items to should be setup & submitted in the following format:

1. Specification Changes – Shown as red-line copy (see note)
2. Project Specific Special Provisions (SP) – Will be shown in all black.
3. Updates to approved SP – Shown as red-line copy

Each item should also include a description with:

- Brief overview of item
- Background info and/or reason for change

NOTE: Red-line copy is a form of editing in which indicate removal or addition of text. You can redline a Microsoft Word document by using the built in “Track Changes” feature or you can

manually redline document with font color changes & strike-through.

OLD BUSINESS ITEMS:

Updated provisions that were discussed at the last committee meeting should be setup in the following format:

- Redline copy from prior meeting would not be shown
- Redline copy of new changes/updates (from previous meeting)

PROGRESSION OF ITEMS THRU COMMITTEE AND APPROVAL:

Depending on how important the project and/or comments/discussion of item at previous meeting, then several things can happen in no particular order

- Few comments/discussion/minor changes ... will recommend approval of item at next meeting
- A lot of comments/discussion ... will not recommend approval at next meeting; item will be updated and reviewed again at next meeting.
- SP's in committee may be used in advertised project. Hope to work to address comments & finish approving at subsequent meeting.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 615
STEEL STRUCTURES**

615.6-ERECTION:

615.6.9-Final Cleaning of Weathering Steel Bridges:

DELETE THE SECOND AND THIRD PARAGRAPHS AND REPLACE WITH THE FOLLOWING (SEE NOTE):

NOTE: The sentence "Do not use acids to remove stains" is shown in 2017 Standard spec book on the line below paragraph two. The intent of the instruction above is to get only this sentence added to paragraph two (and to not modify/delete the paragraph below it starting with "Areas of the shop...").

~~Cleaning may be by high pressure water, powered or hand wire brushing, or by Brush-off Blast Cleaning according to SSPC SP 7/NACE 4. Cleaning shall be followed by a clean water rinse to remove all residues of detergents and cleaners if they were used. All grease and oil shall be removed prior to the clean water rinse by solvent cleaning. Upon completion of all concrete curing operations, the contractor shall clean all steel surfaces to remove all grease, oil, concrete residue, dirt, and other foreign substances in accordance with SSPC SP 1, Solvent Cleaning, to the satisfaction of the Engineer. —Do not use acids to remove stains.~~

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 219

CONTROLLED LOW-STRENGTH MATERIAL

219.5-PAY ITEM:

DELETE THE CONTENTS AND SUBSECTION TITLE AND REPLACE THE FOLLOWING:

219.5-METHOD OF MEASUREMENT:

The quantity of CLSM will be determined by the volume noted on printed batch tickets with subtraction of rejected and wasted material. The Contractor and the Engineer shall agree in advance on a method to determine the volume of waste.

219.6-PAY ITEM:

ITEM	DESCRIPTION	UNIT
219001-*	Controlled Low Strength Material, Type “type”	Cubic Yard (Meter)

* Sequence number

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 642
TEMPORARY POLLUTION CONTROL**

642.4-GENERAL REQUIREMENTS:

ADD THE FOLLOWING SUBSECTION:

642.4.1-Temporary Sediment Basin Floating Skimmer Dewatering Device: The Contractor shall furnish a floating skimmer dewatering device on temporary sediment basin outlet structure in order to dewater the sediment basin. The skimmer assembly, constructed ~~of~~ primarily of Schedule 40 PVC piping, shall be attached to the base of the riser of the basin with a flexible connection and ~~should~~shall be properly vented. The orifice in the skimmer will control the rate of dewatering and shall be sized to dewater the basin in 48 to 72 hours, in accordance with the WVDEP Erosion and Sediment Control Best Management Practice Manual.

The Contractor shall use the manufacturers installation manual to size the skimmer orifice. Manuals and drawings of the skimmer assembly shall be submitted to the Division for review and approval prior to installation.

Contractor shall perform maintenance after significant storm events and routinely inspect to assure proper function of the skimmer.

Contractor shall install and maintain the skimmer in accordance to the manufacturer's guidelines.

642.7-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE END OF THE SUBSECTION:

Skimmer devices shall be measured as a unit, complete and in place, which will include all pipes, fittings, and any other accessories or hardware required to make a complete installation as called for on the Plans or as directed by the Engineer.

642.9-PAY ITEMS:

ADD THE FOLLOWING PAY ITEM.

ITEM	DESCRIPTION	UNIT
642035-002	Skimmer	Each

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 108
PROSECUTION AND PROGRESS**

108.7-COMPLETION DATES:

108.7.1-Failure to Complete on Time and Liquidated Damages:

DELETE THE SECOND PARAGRAPH AND REPLACE WITH THE FOLLOWING:

Therefore, for each calendar day the project is deemed not to be Substantially Complete after the Contract Time specified for completion of the work, subject to such extensions of contract time required or permitted in 108.6, the Division will assess liquidated damages against the Contractor. Daily charges will be deducted for each calendar day, as defined in 101.2 on all contracts. The total amount of daily charges will be deducted from any monies due the Contractor, not as a penalty but as liquidated damages. Unless specified elsewhere in the Contract, the amount of the daily charge will be calculated ~~from the table posted at the WVDOH Contract Administration's Specifications and Documents web page:~~

~~<http://www.transportation.wv.gov/highways/contractadmin/specifications/Pages/LiquidDatedDamages.aspx>~~

~~using Table 108.7.1 on the date of the project is first advertised letting.~~

~~An adjustment of Contract time will be considered for loss of time due to adverse weather.~~

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 601 STRUCTURAL CONCRETE

601.3-PROPORTIONING:

601.3.1-Mix Design Requirements:

DELETE TABLE 601.3.1A AND REPLACE WITH THE FOLOWING:

TABLE 601.3.1A {US CUSTOMARY}

Class of concrete	Design 28 Day Compressive Strength	Target Cement Factor	Maximum Water Content	Standard Size of Coarse Aggregate***	Entrained Air
	Pounds per Square inch	lbs./c.y. *	lb. of water / lb. of cement **	Number	Percent
A	3500	682	0.51	7, 78, or 8	7.5 <u>7.0</u>
K	4000	658	0.44	57, 67	<u>7.0</u>
B	3000	564	0.49	57, 67	<u>7.0</u>
C	2500	494	0.58	57, 67	<u>6.0</u>
D	2000	400	0.62	57, 67	5.5 <u>5.0</u>
H	4000	See Table 601.3.1C	0.40	57,67	6.5
DC	4500	705	0.44	7, 78, 8	<u>6.0</u>

TABLE 601.3.1A {METRIC}

Class of concrete	Design 28 Day Compressive Strength	Target Cement Factor	Maximum Water Content	Standard Size of Coarse Aggregate***	Entrained Air
	Mpa	Kg per cu. m. *	L/Kg of cement **	Number	Percent
A	24	404	0.51	7, 78, or 8	7.5 <u>7.0</u>
K	28	390	0.44	57, 67	<u>7.0</u>
B	21	335	0.49	57, 67	<u>7.0</u>

C	17	295	0.58	57, 67	<u>6.0</u>
D	14	235	0.62	57, 67	5.5 <u>5.5</u>
H	28	See Table 601.3.1C	0.40	57, 67	6.5
DC	31	418	0.44	7, 78, or 8	<u>6.0</u>

- * An equal mass of a SCM may be substituted for Portland cement up to the maximum amount in Table 601.3.1B. Only one SCM is permitted in a mix design, except for Class H concrete. The target cement factor of Class H concrete shall consist of Option 1 or Option 2 from Table 601.3.1C. The Contractor may choose either option.
- ** When using a SCM, masses of these materials shall be considered as cement for purposes of establishing maximum water content.
- *** A number 67 coarse aggregate may be used in Class DC concrete, provided the Engineer approves the use of that size aggregate for the specific project on which it is to be used. That approval will depend on the minimum spacing of the reinforcing steel in the drilled caisson.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 604
PIPE CULVERTS**

604.8-BACKFILLING:

604.8.1-Initial Backfill Zone:

DELETE THE FIRST PARAGRAPH OF THE SUBSECTION AND REPLACE WITH THE FOLOWING:

Rigid Pipe initial backfill material shall be suitable granular material free from particles larger than 1-½ inch (40mm), crushed aggregate, or controlled low strength material. For flexible pipe, the initial backfill material shall be crushed aggregate or controlled low strength material. The initial backfill material shall be placed along the pipe in layers not to exceed 4 inches (100 mm) and compacted to 95% standard proctor; to a minimum of the spring line for rigid pipe and to a minimum height of 6 inches (150 mm) over the top of flexible pipe. Controlled low strength material (CLSM) shall be placed according to Section 219; and any type of CLSM may be used. Unless otherwise specified in the plans, CLSM can be used as a substitute for granular material or crushed aggregate at the contractor's option. At the contractor's option, and if permitted by the Engineer, Class B concrete may be used as a substitute for CLSM at no additional cost to the Division.

604.8.3-Backfill Testing:

DELETE THE FIRST PARAGRAPH OF THE SUB-SECTION AND REPLACE WITH THE FOLOWING:

The quality control testing and acceptance of CLSM shall be according to in accordance with Section 219. Class B concrete shall be in accordance with Section 601, except that the job site and A-bar testing are waived.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 625
DRILLED CAISSON FOUNDATIONS**

DELETE THE ENTIRE CONTENTS AND REPLACE WITH THE FOLLOWING.

**SECTION 625
ROCK SOCKETED DRILLED SHAFT**

625.1-DESCRIPTION:

The work of this section includes the furnishing of all materials and the construction of rock socketed drilled shaft foundations consisting of reinforced concrete placed within the drilled excavations. Each rock socketed drilled shaft foundation shall consist of an upper drilled caisson portion in a steel casing and a lower rock socket portion.

625.2-SUBMITTALS:

The Contractor shall deliver all submittals required by this specification to the Engineer no later than one month prior to constructing any rock socketed drilled shafts shown in the plans. No rock socketed drilled shafts shall be constructed prior to the Engineer's review and acceptance of all submittals.

625.2.1-Experience:

1. A satisfactory record of experience in rock socketed drilled shaft construction is of the utmost importance in obtaining a satisfactory rock socketed drilled shaft installation. The installation of the drilled shaft is required to be performed by a contractor or specialty subcontractor specializing in installing and having experience with rock socketed drilled shafts of similar length, diameter, and subsurface conditions as those shown in the contract documents.
2. The Contractor shall submit data on at least two projects performed during the past ten years, for which the Contractor, or Contractor's key personnel who will be the on-site supervisor, have installed rock socketed drilled shafts of a range of diameters and lengths similar to those shown in the plans, in similar quantities, and under similar subsurface conditions. The list of projects shall contain names and phone numbers of owners' representatives who can verify the participation in those projects.
3. The Engineer shall review and approve the Contractor's (Subcontractor's) qualifications. If in the opinion of the Engineer the Contractor's qualifications are not

adequate, the Contractor shall submit to the Engineer a proposed method of obtaining the necessary qualifications.

4. The installation of all components of the drilled shaft including; drilling, reinforcement placement, concrete placement, and required wet hole condition work, casing installation and removal, slurry placement, and any other work required to complete the rock socketed drilled shaft, shall be performed by the approved contractor or specialty subcontractor.

625.2.2-Site Inspection: A signed statement shall be submitted affirming that the Contractor (or the Subcontractor if applicable) has inspected the project site and the available subsurface information including any available soil or rock samples.

625.2.3-Installation: The Contractor shall comply with applicable environmental regulations, including but not limited to the protection of river water from degradation due to material excavated from rock socketed drilled shaft locations or due to other harmful erosion, protection of the environment from slurry spillage or discharge if slurry is used, and general environmental protection of the area from all operations related to rock socketed drilled shafts.

The installation shall be in accordance with the Contractor's proposed Safety Plan per Section 625.6.1.7.

The Contractor shall provide a projected schedule of work to the MCS&T Division, DOHMCSTcaisson@wv.gov, thirty (30) days in advance of construction of drilled shafts. ~~This projected schedule shall include start date of the drilled shaft construction, date of when each preinstallation core hole would need to be drilled, date of when each drilled shaft would need to be inspected for plumbness, cleanliness, and when CSL tests are to be performed for each drilled shaft.~~ This projected schedule will be used by the MCS&T Division to schedule preinstallation core hole drilling and drilled shaft inspection.

625.2.4-As-Built Records: Within 24 hours of the completed construction of each drilled shaft, the Contractor shall submit a report on the actual location, alignment, elevation, and dimensions of the drilled shaft, and will also submit a completed drilled shaft log.

625.3: Blank

625.4-DIMENSIONAL REQUIREMENTS:

If the specified dimensional requirements are not met, the Contractor shall submit a corrective plan for any deviation from the drilled shaft location, alignment and elevation tolerances, and reinforcement dimensional requirements to the Engineer for approval. This approval may take up to fourteen (14) calendar days. The corrective plan shall be certified (signed by a Professional Engineer licensed in West Virginia knowledgeable in rock socketed drilled shaft installation). The cost of any corrective action shall be borne by the Contractor.

625.5-MATERIALS:

625.5.1-Concrete: Concrete for the rock socketed drilled shafts shall be Class DC and shall conform to the requirements of Section 601.

The design 28-day compressive strength shall not be less than 4500 psi (31 Mpa) unless shown otherwise in the Plans. The Contractor shall prepare a mix design in accordance with MP 711.023.23 to attain this strength. Slump for dry placement shall be 7 inches (175 mm)

plus-or-minus 1 inch (25 mm). Unless otherwise specified in the Plans, the cement shall be Type I.

For placement of concrete by tremie or pumping, the cement factor shall be increased by 94 lbs. (43 kg) from the original design cement factor, the slump shall be 8 inches (200 mm) plus-or-minus 1 inch (25 mm) and shall maintain a slump in excess of 4 inches (100 mm) throughout the concrete placement.

625.5.2-Reinforcing Steel: Reinforcing steel for main vertical bars and ties shall conform to Section 709.1, deformed type, grade 60 (400). Reinforcing steel for use as spirals shall conform to Section 709.1, plain type, grade 60 (400).

625.5.3-Casing: Metal casing shall be used in the caisson portion of the shaft to prevent caving of the soil material or to exclude ground water. Casing shall be metal, of unit or sectional construction, be strong enough to withstand handling stresses, withstand the pressures of concrete and of the surrounding earth and ground water, and prevent seepage of water. Also, the casing used shall be selected by the Contractor to control dimensions and alignment of excavations within tolerances, to seal the casing into impervious materials, and to execute all other construction operations.

Casing pipe used for permanent applications shall be new material and conform to ASTM A 252/A 252M, Grade 2. Casing pipe, when used for temporary applications only, will initially be required to meet the requirements of permanent pipe but when removed can be transferred to the contractor's stock and reused on subsequent projects.

Any required casing splices shall be welded with no interior splice plates, producing true and straight casing. All welding shall be in accordance with ANSI/AWS D1.1.

Permanent casing is required in all drilled shafts where noted on the plans. All temporary casing shall be removed during placement of concrete unless otherwise noted on the plans. Should the Contractor be unable to remove the temporary casing or if conditions require the temporary casing remain in place, the Contractor shall pressure grout the annular space between the casing and soil. Materials and methods for grouting operation shall be submitted to the Engineer for approval for the grouting operation. There shall be no additional cost to the Division for the grouting operation.

625.5.4-Crosshole Sonic Logging (CSL) Testing Tubes: Tubes required for CSL Tests shall be ASTM A53, Grade B, nominal 2-inch (50 mm) diameter. Hydrostatic test requirements are waived. Threaded Couplings shall be used per ASTM A 865.

625.5.5-Thermal Integrity Profiler (TIP) Wires: Wire, equipment, and testing procedure shall conform to ASTM D7949, Method B.

625.6-CONSTRUCTION: The following sequence describes a generalized construction method that is expected to be appropriate for the installation of the rock socketed drilled shafts. Deviations will be permitted with the Engineer's approval.

- a. Contractor shall provide suitable access to the "Preinstallation Core Hole" location at each drilled shaft.
- b. Drilling of a "Preinstallation Core Hole" will be performed by the Division as specified in 625.7.2.1.

- c. Drilling of cased hole through the soil overburden down to top of competent rock. Seating bottom of casing to minimize entry of ground water.
- d. Drilling of rock socket to the minimum diameter shown in the plans and to an elevation shown on the drawings or otherwise directed by the Engineer.
- e. Determination of wet or dry hole condition, by the Division, as specified in 625.7.2.2.
- f. Inspection of drilled hole for plumbness, by the Division, as specified in 625.7.2.3.
- g. Cleaning of the drilled hole by the Contactor, particularly the rock socket and the inside face of the casing, as specified in 625.7.2.5.
- h. Inspection of the drilled shaft sidewall and bottom cleanliness, by the Division as specified in 625.7.2.4 and 625.7.2.5.
- i. Placement of the pre-assembled cage of reinforcing steel with CSL tubes and/or TIP wires and securing it in place against movement during concreting and during casing withdrawal, as specified in 625.6.2. It also must be secured in such a way that the minimum clear cover over the bars is maintained.
- j. Placement of concrete in either dry or wet conditions. The temporary casing shall be withdrawn carefully and slowly so as not to leave any voids in the concrete and so as not to dislocate any reinforcing steel. Any concrete not meeting this specification's slump requirements will be rejected.
- k. Curing, stripping, and finishing shall be the same as for other structural concrete. Casing may be used as forms.
- l. Inspection of the concrete, by the Division as specified in 625.7.2.6.
- m. Corrective measures for any unacceptable drilled shaft, removal of water from the CSL tubes and filling with an approved grout. All core holes, as specified in 625.7.3, must be filled with an approved grout.

625.6.1-Excavation:

625.6.1.1-Scope: The Contractor shall perform all excavations required for the drilled shafts and the rock sockets, through whatever materials are encountered, to the dimensions shown in the plans, or required by the site conditions, or directed by the Engineer. The Contractor shall make each drilled shaft excavation available to the Engineer for inspection, providing tools, equipment, and safety measures as hereinafter specified. Based on preinstallation core hole information or on general inspection of the rock socket, the Contractor shall drill the rock socket deeper if directed by the Engineer.

625.6.1.2-Excavation through Overburden: Unless otherwise shown in the plans, rock socketed drilled shaft excavations in the overburden shall be vertical bored holes extending from the ground surface down to the surface of competent rock. Temporary or permanent casings shall be required down to the competent rock surface and be seated in rock in a manner that prevents caving and minimizes the entry of ground water. In the event of a groundwater condition, appropriate measures shall be taken subject to the Engineer's approval. Such measures may include pumping from within the excavation, external dewatering, or excavation through a slurry-filled hole until the casing can be seated and sealed.

625.6.1.3-Excavation in Rock: Rock sockets shall be excavated to the dimensions and depths shown in the plans, forming a bearing area at the bottom of the socket, flat to within a tolerance of 1/2 inch per foot. Each socket shall be excavated into continuous rock for the

indicated length. Blasting methods will not be permitted.

The top elevation of competent rock must be confirmed as the socket drilling is started. The effective "top elevation" is based on observation of the boundary zone where broken or weathered rock becomes competent rock and is also influenced by the presence of any shale or coal seams. Based on that elevation, and the information from the preinstallation core hole, the Engineer will determine the final depth of socket and bottom elevation.

Upon completion of each rock socket excavation, the Engineer may (1) accept the socket, or (2) order deeper excavation based upon preinstallation core hole data or general inspection of the socket. The adequacy of each socket will depend on the soundness of its bottom surface and on the soundness of its underlying layers.

Contractor is cautioned not to over-drill the rock sockets. Unauthorized over-drilling will be at the Contractor's expense. In the case where over-drilling would bring the drilled shaft base too close to a coal seam or other weak layer, then drilling must be extended through such weak layer, at the Contractor's expense, to a satisfactory deeper bearing level as determined by the Engineer.

No portion of the rock socket shall be exposed to drilling fluid or groundwater for more than 96 hours. Any portion of the rock socket exposed to drilling fluid or water for more than 96 hours, and any portion of the rock socket which, in the opinion of the Engineer, has deteriorated due to exposure to air or water, shall be reamed with an approved grooving tool to a depth of not less than ¼ inch (6 mm), or as directed by the Engineer. Reaming of the socket, if necessary, is considered incidental to the cost of drilling the rock socket, and no separate payment will be made for this work.

625.6.1.4-Providing for Socket Inspection: Upon completion of the excavation of each rock socket, and upon mechanical cleaning of the socket, the Contractor shall make the socket available to the Engineer for inspection, as specified in 625.7.

625.6.1.5-Disposal of Materials: Disposal of excavated materials shall be accomplished under the general provisions of Section 207.6.

625.6.1.6-River Area: Rock socketed drilled shaft construction in the river shall employ whatever special methods the Contractor finds necessary for access and for accomplishing the work. These methods may include cofferdams, temporary causeway, or other suitable measures. The Contractor will be responsible for conforming to all regulatory and environmental requirements related to the river and for obtaining any permits that are required by his river operations.

625.6.1.7-Safety Measures: Safety of all persons is to be considered an objective of the utmost importance on all projects. Therefore, the Contractor shall take whatever measures are necessary to protect his own personnel, his subcontractors' personnel, the Engineer or other agents of the state, regulatory personnel, and others including the general public. The following list is presented as representative of issues that the Contractor must address. It is not intended as all-inclusive and does not relieve the Contractor of conforming to other regulations, laws, requirements, or other measures reasonably required for safe excavating operations. The Contractor shall develop a safety plan in accordance with these requirements and provide this plan to the Engineer for his review.

- a. Any required equipment within an excavation shall be operated by air or electricity. The use of gasoline-driven engines or diesel engines within an excavation will not be permitted. All lighting shall be electric, and precautions shall be taken regarding potential short circuits of electric current within ground water.
- b. The Contractor will take precautions to assure that no explosive or noxious gases are present. Fresh air shall be supplied into the excavation and foul air shall be removed whenever any personnel are present in the hole.
- c. A safety harness or chair lift, with separate safety line, protective cage, and two-way radio communication shall be used for any entry into an excavation.
- d. No open excavation shall be left unattended. During non-working hours excavations shall be protected using solid, safe covers that are firmly fastened in place.

625.6.2-Reinforcing Steel Installation: Prior to installation of reinforcing steel, the steel cage shall be checked and cleaned of any materials that would tend to prevent bonding. The excavated hole shall also be checked, and any remaining or newly deposited debris shall be removed. Immediately upon the Engineer's approval of the condition of the cage and his acceptance of the socket, and just prior to placement of concrete, the fully assembled cage of reinforcing steel shall be installed into the excavation.

The cage will consist of longitudinal (vertical) bars, spiral or tie bars, cage stiffener bars as required, spacing devices, and any other appurtenances required to maintain alignment, shape, and clearances. Cages shall include steel tubes and TIP wires in shafts where CSL and TIP testing is to occur as outlined in 625.6.2.1. Each cage shall be placed in one unit by lowering into the hole in a manner that will prevent distortion. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals (near the bottom and at intervals not exceeding 10 ft (3 000 mm) along the drilled shaft) to ensure concentric spacing for the entire cage length. The minimum number of centering devices at each level shall be three. All steel centering devices with less than 3 inches (75 mm) of concrete cover shall be epoxy coated. The cage shall be supported from the top by use of a ground surface frame or other positive means. Setting the cage on the socket bottom without support will not be permitted. The Contractor may, with the approval of the Engineer, remove the top support after sufficient concrete has been placed to adequately support the cage vertically and prevent distortion or racking of the cage.

The bottom of the reinforcing steel cage shall be a minimum of 3 inches (75 mm) and a maximum of 24 inches (600 mm) from the bottom to the rock socketed drilled shaft excavation. Additional clearance may be approved by the Engineer.

All intersections of rock socketed drilled shaft reinforcing steel shall be tied with cross or “figure 8” ties. The reinforcing steel in the drilled shaft shall be 100% tied and supported so that the reinforcing steel will remain within allowable tolerances for position. Unless otherwise shown in the plans, splicing shall be by mechanical connectors or couplers which develop at least 125% of yield strength of the reinforcing bar. No more than 50% of the longitudinal reinforcing shall be spliced within 60 bar diameters of any lapped splice location or within 2 ft (600 mm) of any mechanical splice or coupler location. Cage stiffener bars shall be used as required to provide a reinforcement cage of sufficient rigidity to prevent racking, permanent deformations, etc. during installation. If the concrete is to be placed by the free-fall method, these bars must first be removed.

In the event that the drilled shaft has been excavated below the anticipated tip elevation, the reinforcing cage may be extended at the tip (bottom) end by lap splices, mechanical connectors,

or welded splices in conformance with the Standard Specifications. In this instance, splices need not be staggered and 100% of the reinforcing bars may be spliced at a given location. Lap splice lengths shall be as shown in the plans or approved by the Engineer.

Prior to placing the reinforcement cage, the Contractor shall demonstrate to the satisfaction of the Engineer that the fabrication and handling methods to be used will result in a reinforcing cage placed in the proper position, with the proper clearances, and without permanent bending or racking of the reinforcement cage.

The elevation of the top of the steel cage shall be checked before and after the concrete is placed. If the rebar cage is not maintained within the specified tolerances, corrections shall be made by the Contractor to the satisfaction of the Engineer. No additional drilled shafts shall be constructed until the Contractor has modified his reinforcement cage support system in a manner satisfactory to the Engineer.

625.6.2.1-Contractor Preparation for Testing: To accommodate the CSL and TIP test requirements, the Contractor shall install the appropriate number of tubes and/or TIP wires in each drilled shaft to be tested. The number of tubes and wires per drilled shaft shall be as tabulated below:

TABLE 625.6.2.1

Drilled shaft Diameter	Number of CSL Tubes	Number of TIP wires	Tube / Wire Spacing
< 42" (1049 mm)	3	0	120°
42" to ≤ 60" (1050 mm to 1499 mm)	4	0	90°
> 60" to ≤ 96" (1500 mm to 2399 mm)	6	6	60°
> 96" (2400 mm)	8	8	45°

The tubes shall be per 625.5.4. Each tube shall have a round, regular internal diameter free of defects or obstructions including defects or obstructions at pipe joints; in order to permit the free, unobstructed passage of 1½ inch (35 mm) diameter source and receiver probes. The tubes shall be watertight and free from corrosion with clean internal and external faces to ensure passage of the probes inside and a good bond with the concrete outside.

Each tube shall be fitted with a watertight shoe on the bottom and a removable cap or plug on the top. The tubes shall be securely attached to the interior of the reinforcing steel cage. The tubes are typically wire-tied to the reinforcing cage every 40 inches (1 000 mm), or otherwise secured such that the tubes stay in position during placement of the cage and during placement of concrete. The tubes shall be installed in each shaft in a regular, symmetric pattern such that the tube spacing in degrees will correspond to that shown in the table above.

The tubes shall be as near to parallel as possible. They shall extend from 6 inches (150 mm) above the drilled shaft bottom to at least 40 inches (1 000 mm) above the drilled shaft top. No tube may be allowed to rest on the bottom of a drilled excavation. If the drilled shaft top is sub-surface, then the tubes shall extend at least 2 ft (600 mm) above the ground surface or above the water surface if the ground surface is below water. Any joints required to achieve full length tubes shall be made watertight. The Contractor shall investigate all CSL tubes, making sure that there are no bends, crimps, obstructions or other impediments to the free passage of the testing probes. A record of the tube lengths, including a note of the projection

of the tubes above the top of the shaft shall be made. The Contractor shall provide information on the shaft bottom and top elevations, length and construction dates to the Engineer prior to the CSL tests. Care shall be taken during placement of the reinforcing steel cage so as not to damage the tubes.

After placement of the cage, and before placement of concrete, the tubes shall be filled with clean water and the tube tops shall be capped or sealed to keep debris or other foreign matter out of the tubes. Care shall be exercised in the removal of caps or plugs so as not to apply excess torque, hammering, or other stresses that could break the bond between the tubes and the concrete.

The TIP wires shall be per 625.5.5.

625.6.3-Placement of Concrete: Method of placement shall be determined by measuring the water infiltration rate into the shaft as specified in Section 625.7.2.2. Concrete placement for wet hole shall be placed by tremie. Free fall placement shall be permitted for dry hole condition, except that free fall height shall not exceed 5 feet (1500 mm) unless the concrete is placed using a drop chute or centering device. Free fall height is not restricted as long as a drop chute or centering device is used, and the concrete is directed down through the center of the shaft without directly hitting the reinforcing cage or the sides of the hole. Dry hole shall not have more than 3 inches of water in the bottom of hole at start of concrete placement.

Prior to concrete placement, the Contractor shall make all necessary arrangements to ensure the uninterrupted delivery of concrete so that there will not be any cold joints in the drilled shafts. Placement of concrete shall generally conform to the applicable portions of Section 601.10. The rate of placement of concrete, as related to the height of fresh concrete at any time, will be subject to the Engineer's approval. The placement method will be developed by the Contractor, taking account of set time, hydraulic pressures and casing removal.

All costs of replacement of defective drilled shafts shall be the responsibility of the Contractor and shall be at no cost to the Division.

After the concrete level has reached the required top elevation, it shall be forced to overflow in the case of tremie or pump placement, leaving only fresh, uncontaminated concrete. In the case of placement by free fall (dry conditions), the concrete shall be continued high enough to compensate for any settlement due to removal of casing.

The top 10 ft (3000 mm) of each rock socketed drilled shaft shall be vibrated except when more than 10 ft (3000 mm) is to be exposed above the ground line or the riverbed, then the entire exposed portion shall be vibrated. The concrete shall not be vibrated until after any temporary casing is removed. Exposed portions of each rock socketed drilled shaft shall be cured in accordance with Section 601.12.

625.6.4-Removal of Casing: Removal of the casing from a shaft may occur gradually as concrete is placed. Insofar as possible, casing extraction shall be done at a slow uniform rate by application of a steady vertical upward pull in the direction of the axis of the shaft. To facilitate extraction, tapping on the casing, exertion of temporary downward pressure, slight rotation, or the controlled use of a vibratory hammer will be permitted, but care must be taken to avoid harmful impacts or disturbances to the fresh concrete. Vibration or rodding may not be used to break the casing loose for extraction.

If, during extraction of casing, upward movement of concrete and/or reinforcing steel occurs, the Engineer shall be notified immediately. If the Engineer considers the movement to be minor,

then the extraction of the casing may continue. If, however, the movement is deemed significant and indicative of squeezing of the surrounding soil thus resulting in a reduction of the drilled shaft diameter, then the Engineer may order the casing to be left in place, or permit extraction to proceed and order a later non-destructive load test, or may order other procedures as appropriate at no additional cost to the Division.

For the upper portions of rock socketed drilled shafts that will be exposed and visible, the casing may remain in place as a form until the concrete has attained a strength that enables it to stand alone without further deformation. Casing shall then be removed.

625.7-INSPECTION OF SOCKETS:

625.7.1-Inspection: The Engineer will inspect the shaft as outlined in 625.7.2.4 and 625.7.2.5.

Time required for inspection will be considered incidental to the work and will not be cause for extra compensation related to a claim or extension of contract time.

625.7.2-Division Testing:

625.7.2.1-Preinstallation Core Holes: The Contactor shall provide notice to the MCS&T Division via e-mail (DOHMCSTcaisson@wv.gov) when each site is ready for drilling. The Division will commence drilling of the preinstallation core hole within 5 working days after notification from Contractor that site has suitable access for drilling.

A preinstallation test boring will be drilled by the Division at each drilled shaft location, or as shown on the plans, to determine the character of the material that the drilled shaft extends through and the material that is at the base of the shaft in order to ensure the material along and below the tip of the rock socket is capable of carrying the load that will be imposed on it. The preinstallation borings are to be drilled prior to beginning excavation for each representative rock socketed drilled shaft. The Contractor shall provide all work necessary to allow access for the drill rig to the preinstallation test boring location, which at a minimum shall include constructing drill pads and access roads.

Unless otherwise directed, the preinstallation test borings are to be extended a minimum depth of 2 drilled shaft diameters but not less than 10 feet below the planned tip elevation of the rock socketed drilled shaft shown on the plans. Standard Penetration Testing (SPT) and sampling shall be performed at 5-foot intervals in the preinstallation borings in accordance with AASHTO T 206. Rock coring will be performed in accordance with ASTM D2113 using a wireline core barrel system and will commence immediately upon obtaining an SPT value of 50 blows per 6-inches or less on bedrock. The recovered core sample size will be approximately 2-inch diameter (NX or NQ size). Additional preinstallation test borings in other locations may be required where directed by the Engineer.

Test boring logs of each preinstallation boring will be prepared by the Division and will be provided to the Contractor within 3 working days of completion of the test boring. The preinstallation test borings logs will describe the type and thickness of all soil and rock layers, and locate the presence of groundwater, open joints, voids, soft rock, or other deleterious material. All recovered soil and rock samples shall be maintained by the Division and stored on site at suitable location, provided by the Contractor, until completion of the project.

Within 10 working days after completion of preinstallation core hole, the Engineer will

notify the Contactor of the final tip elevations for each drilled shaft location.

625.7.2.2-Wet or Dry Hole Determination: The Division will check the depth of water at the bottom of the drilled shaft. If the depth, ~~without pumping~~, does not increase by more than 12 inches over a 1-hour period, the hole will be considered dry. Otherwise, the hole will be considered wet.

625.7.2.3-Plumbness: Contractor shall provide notice to the MCS&T Division via e-mail (DOHMCSnTcaisson@wv.gov) 5 working days prior to the date each drilled shaft will be ready for inspection.

Plumbness of the rock socketed drilled shaft/rock socket shall be measured by the Division by measuring the geometry of the drilled shaft excavation using SHAPE, Sonicaliper, or other suitable means. For any rock socketed drilled shaft, the maximum permissible deviation from plumb shall be 1.5% measured with respect to the vertical axis at the center of the drilled shaft excavation.

The Contractor shall provide suitable access and means for lowering inspection equipment into the drilled shaft excavation.

For any rock socketed drilled shaft at its top, the maximum deviation of the center shall be 3 inches from its project plan location. The maximum deviation of the finished top of shaft from the plan elevation shall be minus 1 inch or plus 3 inches. An absolute minimum cover of 3 inches to the reinforcing steel is strictly required. In the event of any deviations in the dimensional requirements, the contractor shall not proceed with construction of pier columns or cap until submission and approval of a corrective plan has been granted.

625.7.2.4-Rock Sock Sidewall Inspection: Contractor shall provide notice to the MCS&T Division via e-mail (DOHMCSnTcaisson@wv.gov) 5 working days prior to the date each drilled shaft will be ready for inspection.

The Division will inspect the rock socket side walls with a downhole camera or other suitable device. The Engineer shall evaluate the rock quality and construction, as outlined in 625.6.1.3.

625.7.2.5-Shaft Bottom Cleanliness: Contractor shall provide notice to the MCS&T Division via e-mail (DOHMCSnTcaisson@wv.gov) 5 working days prior to the date each drilled shaft will be ready for inspection.

The contractor shall clean the rock socket so that a minimum of 75% of the base will have less than ½ inches of sediment at the time of placement of the concrete. Sediment depth at any location shall not exceed 1 ½ inches. The Division shall determine shaft cleanliness by using a mini-SID, SQUID, or other suitable device. The contractor shall use an air-lift to achieve the required bottom cleanliness.

The contractor shall begin concrete placement in the shaft within 3 hours after the shaft bottom cleanliness is approved. If concrete placement in the drilled is not started within 3 hours, the rebar cage shall be removed, and hole shall be re-inspected at no additional time to the Contractor or cost to the Division.

625.7.2.6-In-place Concrete Quality Testing: The Contractor shall furnish and place the Crosshole Sonic Logging (CSL) tubes and thermal integrity profiler (TIP) wires in all

drilled shafts. The number of tubes and tip wires to be used shall be as specified in 625.6.2.1. The Division will perform the testing and provide a report of the drilled shaft integrity testing to the Contractor. The CSL tubes shall remain open in the shaft and be grouted by the Contractor after acceptance of that shaft.

625.7.2.6.1-Crosshole Sonic Logging (CSL): The nondestructive testing method known as CSL shall be used on any rock socketed drilled shaft which is constructed with the placement of concrete under wet conditions or as required in the plans. The testing shall not be conducted until at least three (3) days after placement of concrete is concluded in the drilled shaft and will be completed within fourteen (14) calendar days after such placement.

The CSL tests shall be conducted in conformance with ASTM D6760 and by a testing company approved by MCS&T Division.

The Contractor shall comply with the scheduling and notification requirements for drilled shaft construction outlined in Section 625.2.3 by contacting the following MCS&T Division e-mail address: (DOHMCSnTcaisson@wv.gov). This will allow MCS&T Division to provide a qualified company to perform testing within the time frames allotted for in this subsection.

625.7.2.6.1.1-CSL Testing Results: The CSL test results will be compiled into a drilled shaft integrity testing report for each drilled shaft. The report will summarize and analyze any defect zones indicated on the logs. A copy of each report will be provided to the Contractor.

625.7.2.6.1.2-Evaluation of CSL Test Results: The Engineer will review the report and, if the report determines that the drilled shaft is acceptable, will submit to the Contractor in writing within seven (7) calendar days approval to proceed with the work.

The rating of the rock socketed drilled shaft integrity will consider the increases in first arrival time (FAT) and the energy reduction relative to the FAT or energy in a nearby zone of good concrete. The criteria for rating the concrete from the CSL test will be:

TABLE 625.7.2.6.1.2	
Rating	Criteria
Good (G)	FAT increases 0-10% and energy reduction < 6 db
Questionable (Q)	FAT increases 11-20% and energy reduction < 9 db
Poor / Flaw (P/F)	FAT increases 21 to 30% or energy reduction of 9 to 12 db
Poor / Defect (P/D)	FAT increases 31% or more or energy reduction >12 db

Flaw or defect zones as indicated in Table 625.7.2.6.1.2 will be indicated on the logs and listed in a table within the report. The flaw or defect zones and their horizontal and vertical extent will be discussed in the report text. Flaws will be addressed by the Division if they affect more than 50% of the tested tube pairs at the same depth. Defects will be addressed by the Division if they affect two or more of the tested tube pairs at the same depth. At a minimum, addressing flaws and defects will include Crosshole Tomography (CT). If it is determined that the rating is less than Questionable, based on the results of the CSL and CT testing, the Division will require core drilling and sampling by the Contractor for further evaluation of the flaw or defect at no additional cost to the Division. The diameter, number, depth, and location of cores shall be as directed by the Engineer.

The acceptance of each drilled shaft shall be the decision of the Engineer, based on the results of the drilled shaft integrity testing report and other information on the drilled shaft placement. Rejection of a drilled shaft shall require conclusive evidence that a defect exists in the drilled shaft, which will result in inadequate or unsafe performance under service loads. If the Non-Destructive Testing records are complex or inconclusive, the Engineer will require the Contractor to verify drilled shaft conditions by core drilling. If a flaw or defect is confirmed, the Contractor shall pay for all coring and grouting costs. If no flaw or defect is encountered, compensation for all coring and grouting will be in accordance with 104.3 and 109.4.

625.7.2.6.1.3-Remedial Action: In the case that any drilled shaft is determined to be unacceptable, the Contractor shall submit a plan for remedial action to the Engineer for approval. The approval or rejection of the remediation plan may take up to fourteen (14) calendar days. If the remediation plan is rejected the Contractor shall revise the plan and submit it for approval and the approval time is restarted. Any modifications to the foundation drilled shaft and load transfer mechanisms caused by the remedial action will require calculations and working drawings stamped by a Professional Engineer licensed in the State of West Virginia for all foundation elements affected. All labor and materials required to perform remedial drilled shaft action shall be provided at no cost to the Division and with no extension of the contract time.

625.7.2.6.2-Thermal Integrity Profiler (TIP): Perform TIP testing using the embedded thermal wire array, and in accordance with the ASTM test method D7949 (method b). Thermal integrity profiling is performed to evaluate shaft integrity and location of the reinforcing cage. The number of wires to be used shall be as specified in 625.6.2.1. Thermal wire cables shall be connected to a thermal access port (TAP) immediately following casting.

The Contractor shall provide cooperative assistance and labor as required to assist the Division in inspecting the thermal wires prior to concreting the shaft. Prior to TIP testing, the contractor shall provide shaft installation details to the TIP consultant. Because the method relies on the heat of hydration, tip testing is generally performed between 8 and 48 hours of concrete placement (note the optimum TIP testing time is dependent on shaft size and concrete mix and could range from 4 to 72 hours).

625.7.2.6.2.1-Criteria to be used for acceptance or rejection of rock socketed drilled shaft using TIP testing: The rating of the shaft integrity using tip shall consider variations in temperature as measured by the thermal wires. Potential local anomalies may be indicated by locally low temperatures relative to the average temperature at that depth, or average temperatures significantly lower than the average temperatures at other depths. The criteria for rating the concrete from the TIP test shall be:

Satisfactory (s) = 0 to 6% effective radius reduction and cover criteria met

Anomaly (a) = effective radius reduction > 6% or cover criteria not met

When a tested shaft is categorized as anomaly (a), slices modeled at the area of question may be provided so that a structural evaluation of the shaft can be performed prior to implementing any corrective measures. Core drilling shall be performed to investigate problem areas found during TIP testing.

625.7.3-Evaluation by Core Drilling: A rock socketed drilled shaft that is found to be unacceptable shall be core drilled by the Contractor ~~using double tube core barrels in accordance with ASTM C42.~~ Cores shall be 4" nominal diameter. One or more core holes shall be drilled at the location(s) as determined by the Engineer. An accurate log of the core shall be kept, and the core shall be crated and properly marked showing the drilled shaft depth at each interval of core recovery. The core and one copy of the coring log shall be provided to the Engineer.

The Engineer shall determine if the rock socketed drilled shaft is acceptable. The Engineer will submit to the Contractor in writing within seven (7) calendar days approval to proceed with the work. If the quality of the drilled shaft is determined to be unacceptable, then the Contractor shall proceed in accordance with 625.7.2.6.1.3.

625.8-METHOD OF MEASUREMENT:

Rock socketed drilled shafts and Rock Socket foundations will be measured by the linear foot (meter). For payment purposes, the drilled shafts are the portion from the finished top of each rock socketed drilled shaft to the top of competent rock. Rock Socket is the portion from the top of competent rock to the bottom of the drilled shaft rock socket as shown in the plans or as directed by the Engineer. Each measured drilled shaft is to be complete in place, accepted, and ready to function. "Top of drilled shaft" is the top of concrete as shown in the plans. "Top of competent rock" is as tabulated in the drilled shaft schedules in the plans unless a difference of one 1 foot (300 mm) or more is found during drilling.

625.9-BASIS OF PAYMENT:

The accepted quantities of rock socketed drilled shaft foundations, measured as provided above, will be paid for at the contract unit price per linear foot (meter); complete in place including excavation, slurry if required, temporary or permanent metal casing, steel reinforcing, concrete, curing, and any required forming and finishing. No additional payment will be made for temporary casing that remains in place and pressure grouting due to the Contractor's inability to stabilize a drilled excavation, for the need to place concrete by tremie or pumping, for the need to use slurry for drilling, or for extra excavation and concrete that may be required due to drilling diameters larger than the minimum diameters specified. No additional payment will be made for methods employed to gain access to drilled shaft construction or for means required to provide a dry working environment within the drilled shafts. Tubes for CSL testing, TIP wires, and other responsibilities related to testing and inspection assistance are incidental, with no separate payment being made.

625.10-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
625001-*	Drilled shaft "D" Diameter	Linear Foot (Meter)
625003-*	"D" Rock Socket	Linear Foot (Meter)

* Sequence number

D = Diameter of shaft, in inches (millimeters)

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 625
ROCK SOCKETED DRILLED SHAFT**

625.3-BLANK

DELETE THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

625.3-TEST SHAFT:

A rock socketed drilled shaft (test shaft) shall be drilled at the location and to the diameter and depth shown in the plans. The test shaft shall be reinforced, constructed, and tested the same as other rock socketed drilled shafts in the plans. This shall include casing extraction if required by the project. The Contractor shall revise his methods and equipment as necessary during construction of the test shaft when he is unable to carry out the requirements of the plans. Completed test shafts shall be left in place except that the top of the drilled shaft shall be removed to a depth of 2 ft. (600 mm) below final ground line. Disturbed areas at the site of the test shaft shall be restored to their original condition. If the Contractor fails to demonstrate the adequacy of his methods or equipment, the Engineer shall require additional test shafts be provided at the Contractor's expense.

625.8-METHOD OF MEASUREMENT:

ADD THE FOLLOWING TO THE END OF THE SUBSECTION:

Rock socketed drilled shaft test shaft will be measured in Lump Sum basis.

625.9-BASIS OF PAYMENT:

ADD THE FOLLOWING TO THE END OF THE SUBSECTION:

Test shaft will be paid for at the contract lump sum price for each such hole.

625.10-PAY ITEMS:

ADD THE FOLLOWING TO THE TABLE:

ITEM	DESCRIPTION	UNIT
625004-*	"D" Test Shaft	Lump Sum

* Sequence number

D = Diameter of shaft, in inches (millimeters)

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 636 MAINTAINING TRAFFIC

636.24-BASIS OF PAYMENT:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE THE FOLLOWING:

The quantities, determined as provided above, will be paid for at the contract unit price bid for the items listed below, which prices and payment shall be full compensation for furnishing all the materials and doing all the work prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies and incidentals necessary to complete the work. When aggregate for maintaining traffic, dust palliatives, flagger, traffic director, cleaning of traffic control devices or the electric arrow are contained in the contract as pay items, payment for such pay items will not be made subsequent to the date of required completion of the project.

~~When a portable message sign or speed monitoring trailer is to become the property of the Division, each unit shall be delivered with the following items:~~

- ~~i—Operator's manual for sign-raising mechanism and sign operations.~~
- ~~ii—Schematic wiring diagram of the sign, remote control console and the control unit.~~
- ~~iii—Service manual for the sign, sign-raising mechanism control unit and the remote control console.~~
- ~~iv—Record of Serial Numbers, Model Numbers, and Model Types for the Portable message sign and any attendant diesel engine.~~
- ~~v—Warranty on the sign-raising mechanism, sign remote control console and control unit.~~
- ~~vi—Inspection and operational tests.~~

~~“Temporary Structure for Maintaining Traffic” will be paid as partial payments with the following schedule:~~

- ~~i. The Contractor will be paid 75% of the bid price for this item once all the temporary structure work is complete and it is being used to maintain traffic.~~
- ~~ii. The remaining 25% will be paid once it is all removed.~~

If during the prosecution of the work, additional items under this Section, not included in the contract, are found to be necessary as determined by the Engineer, payment for such additional items will be made under the provisions of 104.3.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 641
MITIGATION DEVICES**

DELETE THE ENTIRE CONTENTS AND REPLACE THE FOLLOWING.

641.1-GENERAL:

This work includes furnishing and installing Mitigation Devices. These devices include structures and applications used for environmental mitigation. These structures and applications are to be built in accordance with the details contained in the plans and at the location as noted on the plans.

641.2-MATERIALS:

641.2.1-Rootwads: A rootwad shall consist of a tree with root mass substantially intact. Trunk length shall be as specified in the plans. Trunk length shall measure from the top of the tree's root mass to the end of the trunk. Minimum rootwad diameter shall be as specified in the plans. Tree trunks shall be free of rot or visible degradation and shall be approved by the Engineer prior to installation.

The footer log shall be free of rot or visible degradation and shall be approved by the Engineer prior to installation. The minimum length and diameter of the footer log shall be as specified in the plans.

641.2.2-Live Plant Cuttings: The contractor shall locate and obtain suitable native live plant cuttings as indicated in the plans. The plant cuttings shall have a minimum diameter and minimum length as specified in the plans. The terminal bud shall be removed. If not obtained commercially, live plant cuttings shall not be harvested from existing stream banks in a manner that may constitute a significant disturbance to the area.

641.2.3-Logs for Log Vanes and Log Grade Controls: Logs shall be approved by the Engineer prior to installation. Logs shall have a minimum diameter and length as specified in the plans and shall be reasonably straight. Logs shall be free of rot and visible degradation.

641.2.4-Rocks for Rock J-Hooks, Rock Cross Vanes, and Rock Weirs: Rocks shall be approved by the Engineer prior to installation. Rocks shall have length, width and height dimensions that conform to the minimum and maximum sizes as specified in the plans. Rocks shall have relatively uniform surfaces, so that when placed together there are no significant gaps between adjacent rocks. Rocks shall be sandstone or limestone, free from visible cracks or fissures, and have a density of 150 lb/cf.

641.2.5-Streambed Material: Streambed material will consist of crushed stone and washed gravel (crushed or uncrushed) meeting the general requirements of Sections 703 and 704. This material will be a mixture of angular and sub-angular gravel and cobble-size fragments, 50 percent gravel and 50 percent cobble by weight, as approved by the Engineer. At least 20 percent of the mixture by weight will be large cobble-sized particles, 6 to 10 inches mean diameter (4-inch minimum diameter and 12-inch maximum diameter).

641.2.6-Geotextile Fabric: Geotextile fabric shall meet the requirements specified in 715.11.

CONSTRUCTION METHODS

The approximate locations of all devices are as indicated in the plans. The location of the structures may be adjusted in the field or deleted as directed by the Engineer.

641.3-PLACEMENT:

Mitigation devices shall be placed in accordance with the plans, utilizing construction methods to minimize impacts to aquatic life.

641.3.1-Rootwad Placement: If the rootwad cannot be driven into the bank or the bank needs to be reconstructed, the trenching method shall be used. This method requires that a trench be excavated for the log portion of the rootwad. A footer log shall be installed underneath the rootwad in a trench excavated parallel to the bank and well below the stream bed. The footer log shall be wedged in place with rocks as shown in the plans. The rootwad shall be placed so that the lower portion of the rootwad is slightly below the streambed elevation.

641.3.2-Live Plant Cuttings: Prior to planting the cuttings, they shall be inspected by the Engineer. The time period for installing live plant cuttings shall be indicated in the plans. The period of installation may be extended depending on climate conditions, at the direction of the Engineer or the Engineer.

Live plant cuttings shall be placed as indicated. Live cuttings shall only be used outside the limits of bankfull, as indicated on the plans. Cuttings shall be installed to approximately 80% of the length into the ground. At least two or three viable buds shall be above ground on each cutting in order to promote growth.

641.3.3-Log Vane: Logs shall be placed so that one end is embedded in the streambed and anchored in place by a rock(s) as directed in the plans. The other end of the log shall be

embedded in the stream bank at the bankfull elevation unless directed otherwise by the Engineer or Engineer. Geotextile fabric shall be secured to the back of the log by nailing the fabric to the log. The fabric shall be draped behind the log, down to the stream bed elevation, along the streambed and back up the stream bank to the elevation of the log and then trimmed. The concave cavity formed by the fabric shall be filled to the elevation of the log vane with stream alluvium and tamped in place. A scour pool (hole) shall be excavated downstream of the vane as shown in the plans, and the excavated material shall be used for fill on the upstream side of the vane. Removal and repositioning of up to 25% of the vanes may be required after stream flow observations. The contractor shall ensure that the primary flow from the thalweg is flowing over and in the throat of the structure, after placement.

641.3.4-Rock J-Hooks, Rock Cross Vanes, and Rock Weirs: The approximate locations for the rock structures are indicated in the plans. The location of the structures may be adjusted in the field or deleted as directed by the Engineer. Footer rocks shall be placed individually and keyed into channel bed and bank as indicated in the plans. The remainder of the rocks shall be placed individually above and upstream of footer rocks as shown in the plans. A scour pool (hole) shall be excavated downstream of the rock structure as shown in the plans. Excavated material from the scour pool shall be used for fill on the upstream side of the rock structure. Removal and repositioning of up to 25% of the rock structures may be required after stream flow observations. For J-hook structures, the Contractor shall ensure the deepest part of the channel flows through the trough opening of the rocks forming the J.

When working in a stream with bed material consisting of small gravel, sand or silt clay; geotextile fabric shall be installed behind the rock structure. The fabric shall be securely anchored between the top rock and footer rock and draped down to the stream bed elevation, along the streambed and back up the stream bank to the elevation of the top rock and then trimmed. The concave cavity formed by the fabric shall be filled level to the top of the rock with stream alluvium and tamped in place.

641.3.5-Log Grade Control: Log grade control shall be placed on an “as needed” basis and shall be designated by the Engineer. Logs shall be placed at the head of the riffle to maintain the integrity of the pool directly upstream and maintain the base level of the stream. Logs shall be placed slightly below the intended streambed invert.

When working in a stream with bed material consisting of sand; geotextile fabric shall be installed behind the log grade control structure. Geotextile fabric shall be secured to the back of the log by nailing the fabric to the log. A trench shall be excavated behind the grade control log to a depth of twice the diameter of the grade control log. The geotextile fabric shall be draped in this trench and anchored with rock as directed by the Engineer, then the trench shall be backfilled and tamped.

641.4-BASIS OF PAYMENT:

The quantities shall be paid for as provided below. The prices and payment shall be full compensation for furnishing the excavation, backfill, boulders, and other materials shown on the Plans, for doing the work in a workmanlike and acceptable manner and for the labor, tools, equipment, supplies and incidentals necessary to complete the work.

Footer logs for rootwad placement and the excavation, labor, tools equipment, supplies and incidentals necessary to install them will not be paid for separately, but shall be

included in the cost of the rootwad placement.

Geotextile fabric used for log vanes, rock j-hooks, rock cross vanes, log grade control and the excavation, labor, tools equipment, supplies and incidentals necessary to install it will not be paid for separately, but shall be included in the cost of the structure.

641.5-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
641002-*	Weir	Cubic Yard
641004-*	Rootwad Placement, “trunk length, rootwad diameter”	Each
641010-*	Live Plant Cuttings, see planting table “scientific name”	Each
641020-*	Log Vane, “length, diameter”	Each
641021-*	Rock J-Hook	Cubic Yard
641022-*	Rock Cross Vane	Cubic Yard
641023-*	Log Grade Control, “length, diameter”	Each
641030-*	Streambed Material	Cubic Yard

* Sequence Number

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 642
TEMPORARY POLLUTION CONTROL**

642.6-TEMPORARY PIPE, CONTOUR DITCHES, BERMS, SLOPE DRAINS, DITCH CHECKS, SILT FENCE, PREMANUFACTURED DITCH CHECKS AND SUPER SILT FENCE:

DELETE THE HEADING AND REPLACE WITH THE FOLLOWING:

642.6-TEMPORARY PIPE, CONTOUR DITCHES, BERMS, SLOPE DRAINS, DITCH CHECKS, SILT FENCE, PREMANUFACTURED DITCH CHECKS, SUPER SILT FENCE AND COMPOST FILTER SOCKS:

ADD THE FOLLOWING SUBSECTION:

642.6.6-Compost Filter Socks: Compost filter socks are a three-dimensional tubular sediment control and storm water runoff filtration device typically used for perimeter control of sediment on and around construction activities.

Compost filter socks are also used to reduce runoff flow velocities on sloped surfaces (slope interruption), as curb and drain inlet protection, and as ditch checks. They are placed on the down slope of any disturbed area, perpendicular to the slope where there is sheet or low concentrated flows. They can be utilized in any area that is acceptable to use a silt fence.

Compost filter socks are to have a diameter of 8" to 24". An 8" sock may be used in the areas of curb and drain inlets once approved by the Engineer.

642.6.6.1-Materials: The netting for the compost filter socks ~~is to adhere to the criteria set forth in the table below;~~ shall be made of High Density Polyethylene (HDPE), Multi-Filament Polypropylene (MFPP), Heavy Duty Multi-Filament Polypropylene (HDMFPP) or other equivalent material that may become available in the future. The material shall be photo- or bio-degradable and have a minimum functional longevity of 6 month or more.

Material Type	3-MIL HDPE	5-MIL HDPE	5-MIL HDPE	Muti-Filament Polypropylene (MFPP)	Heavy-Duty Multi-Filament Polypropylene (HDMFPP)
Material characteristics	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameter	8" to 24"	8" to 24"	8" to 24"	8" to 24"	8" to 24"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability-% Original Strength (ASTM G 155)	23%-at 1000-hr.	23%-at 1000-hr.		100%-at 1000-hr.	100%-at 1000-hr.
Min Functional Longevity	6-months	9-months	6-months	1-year	2-years

All materials for the compost filter sock must be knitted. Extruded materials will not be permitted. Compost used for the filter sock shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting 40 CFR 503 regulations including time and temperature data. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted. Test methods for the items below should follow US Composting Council Test Methods for the Examination of Composting and Compost guidelines for laboratory procedures:

- A. PH – 5.0-8.0 in accordance with TMECC 04.11-A, “Electrometric pH Determinations for Compost”
- B. Particle size – 99% passing a 2 in (50 mm) sieve and 30% - 50% passing a 3/8 in (10 mm) sieve.
- C. Moisture content of less than 60% in accordance with standardized test methods for moisture determination.
- D. Material shall be relatively free (<1% by dry weight) of inert materials.
- E. A sample shall be submitted to the Engineer for approval prior to being used and must comply with all local, state and federal regulations.

642.6.6.2-Installation: The compost filter sock shall be installed according to this specification and per the manufacturer’s recommendations.

1. Compost filter socks should be installed parallel to the base of the slope or disturbed area. In addition, a compost filter sock shall be installed at an interval based on the slope specified in Table 6.6.1.

TABLE 6.6.1 Maximum Slope Length Above Filter Sock and Recommended Diameter					
Slope	Ratio (H:V)	8"	12"	18"	24"
<u>Less than 2.0%</u>	10%–20% <u>0 – 50:1</u>	125	250	300	350
<u>2.1% - 10.0%</u> –20%	50:1 - 10:1	100	125	200	250
2% <u>–10.1% - 20.0%</u>	10:1 - 5:1	75	100	150	200
20.1% - 33 <u>49.9%</u>	5:1 - 2:1		50	75	100
50% <u>and over</u>	>2:1		25	50	75

2. Stakes shall be installed through the middle of the compost filter sock on 10 ft. (3 m) centers, using 2 in (50 mm) by 2 in (50 mm) by 3 ft. (1 m) wooden stakes. In the event staking is not possible, i.e., when compost filter socks are used on pavement, ~~heavy~~ concrete blocks heavy enough to prevent movement of the compost filter sock shall be ~~used~~placed behind the compost filter socks to help stabilize during rainfall/runoff events.
3. Staking depth for sand and silt loam soils shall be 12 in (300 mm).
4. If necessary, loose compost may be used to backfilled along the upslope side of the compost filter sock, filling the seam between the soil surface and the device improving filtration and sediment retention.
5. Compost filter socks may be left in place as a permanent filter or part of the natural landscape unless directed by the Engineer to remove them. It may be seeded at time of installation for establishment of permanent vegetation.
6. ~~Compose-Compost~~ filter socks ~~are~~shall not ~~to~~ be placed in streams.

642.7-METHOD OF MEASUREMENT:

ADD THE FOLLOWING AS PARAGRAPH ELEVEN:

Compost filter socks will be measured by the linear foot (meter) in place.

642.9-PAY ITEMS:

ADD THE FOLLOWING PAY ITEM.

642016-001	Compost Filter Sock, 12-8 In.	Linear foot (meter)
642016-002	Compost Filter Sock, 8-12 In.	Linear foot (meter)
642016-003	Compost Filter Sock, 18 In.	Linear foot (meter)
642016-004	Compost Filter Sock, 24 In.	Linear foot (meter)

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 602 REINFORCING STEEL

602.2-MATERIALS:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

Reinforcing steel bars and ~~fabrie-welded wire~~ reinforcement, epoxy coated or plain shall meet the requirements of 709.1 and 709.4 ~~respectively, except rail steel shall not be used in bridge decks or parapets.~~

~~Epoxy coated reinforcing steel bars shall meet the requirements of 709.1.2, except rail steel shall not be used in bridge decks and parapets.~~

Corrosion resistant reinforcing steel bars shall meet the requirements of ~~AASHTO MP18 with minimum yield level of 100,000 psi~~ 709.1.1 for stainless reinforcement and 709.1.2 for low chromium reinforcement respectively. The degree of corrosion resistance for reinforcement shall be specified in the plans.

602.11-PAY ITEMS:

DELETE ITEM 602003 FROM THE TABLE AND REPLACE WITH THE FOLLOWING:

ITEM	DESCRIPTION	UNIT
602003-*	Corrosion Resistant Reinforcing Steel Bar, <u>"type"</u>	Pound (kilogram)

* Sequence number

"type" shall either be stainless or low chromium

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 709

METALS

709.1-STEEL BARS FOR CONCRETE REINFORCEMENT:

ADD THE FOLLOWING:

709.1.1-Stainless Steel Bars for Concrete Reinforcement: For corrosion resistant stainless steel, the material shall meet testing requirements of tensile, yield, elongation, and bend requirements listed in ASTM A955/955M and meet requirements set forth in MP 709.1.50 unless otherwise stated in the project plans.

709.1.2-Low Carbon Chromium Bars for Concrete Reinforcement: For corrosion resistant low carbon chromium steel, the material shall meet testing requirements of tensile, yield, elongation, and bend requirements listed in ASTM A1035/1035M and meet requirements set forth in MP 709.1.50 unless otherwise stated in the project plans.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

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SUPPLEMENTAL SPECIFICATION

FOR

SECTION 709

METALS

709.15-COATED DOWEL BARS & DOWEL BASKET ASSEMBLIES:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

Coated dowel bars shall meet the requirements of AASHTO M254 except that the steel used to make the dowel bars shall meet the requirements of Section 709.1. Additionally, ~~the coating applicator shall meet the requirements of Section 709.1.2 and~~ the saw cut ends of the coated dowel bars shall be touched-up with a coating material in accordance with the requirements of Section 602.6.2.

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DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 715 MISCELLANEOUS MATERIALS

715.4-CONCRETE REPAIR MATERIALS:

DELETE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING.

715.4.1-Cementitious and Polymer-Modified Materials for Concrete Repairs:

Material to be used in concrete repair applications shall be tested through AASHTO's National Transportation Evaluation Program (NTPEP) and meet the requirements in Table 715.4.1. In addition, they must remain current with NTPEP's policy regarding periodic re-testing as required by the program. Product submittals shall include: a completed Form HL-468 (available on the WVDOH Materials Division Web Page), a copy of the technical data sheet, the current Material Safety Data Sheet (MSDS), and the results of NTPEP testing. Any incomplete submittals will not be evaluated for inclusion on WVDOH approved list of concrete patching Materials.

TABLE 715.4.1

Performance Requirements for Cementitious & Polymer-Modified Concrete Materials		
	Test Method	Performance Requirements
3-hour compressive strength	ASTM C39	R1-500 psi (3.5 MPa)
		R2-1,000 psi (7.0 MPa)
		R3- 3,000 psi (21 MPa)
1-day compressive strength	ASTM C39	R1-2,000 psi (14 MPa)
		R2-3,000 psi (21 MPa)
		R3-5,000 psi (35 MPa)
7-day compressive strength	ASTM C39	R1-4,000 psi (28 MPa)
		R2-4,000 psi (28 MPa)
		R3-5,000 psi (35 MPa)
Bond Strength by Slant Shear, 1 Day	ASTM C 882	1,000 psi (7 MPa)
Bond Strength by Slant Shear, 7 Day	ASTM C 882	1,500 psi (10 MPa)

Rapid Freezing & Thawing Durability Factor (DF)	ASTM C 666 (Procedure A)	Minimum Durability Factor 90% at 300 cycles
Length Change	ASTM C 157	allowable increase after 28 days in water +0.15 allowable decrease after 28 days in air —0.15

715.4.2-Polymer Concrete Materials for Concrete Repairs: A Polymer Product is a composite material formed by polymerization of a monomer and an aggregate mixture, in which the polymerized monomer acts as the sole binder for the aggregate. Polymer concrete uses a polymer binder in place of Portland cement. These materials are required to be tested through AASHTO's National Transportation Evaluation Program (NTPEP) and meet the requirements in Table 715.4.2. In addition, they must remain current with NTPEP's policy regarding periodic re-testing as required by the program. Product submittals shall include: a completed Form HL-468 (available on the WVDOH Materials Division Web Page), a copy of the technical data sheet, the current Material Safety Data Sheet (MSDS), and the results of NTPEP testing. Any incomplete submittals will not be evaluated for inclusion on WV DOH approved list of patching Materials.

TABLE 715.4.2

Performance Requirements for Polymer Concrete Materials		
	Test Method	Performance Requirements
Bond Strength Using Slant Shear @ 1 Day	ASTM C 882	1,000 psi (7.0 MPa)
Bond Strength Using Slant Shear @ 7 Days	ASTM C 882	1,500 psi (10.4 MPa)
1-hour compressive strength	ASTM C 579	2,500 psi (17.3 MPa)
24-hour compressive strength	ASTM C 579	3,500 psi (24.1 MPa)
28-day compressive strength	ASTM C 579	5,000 psi (35 MPa)
Chloride Ion Penetration	AASHTO T 277	Less than 750 coulombs @ 28 days
Bond Strength by Direct Tension @ 28 days	ASTM C 1583	Minimum of 300 psi (2.1 MPa)
Linear Shrinkage	ASTM C 531	Maximum Linear Length Change +/- 0.10% at 3 Days
Coefficient of Thermal Expansion	ASTM C 531	2×10^{-6} to 8×10^{-6} in/in/°F (4×10^{-6} to 14×10^{-6} /°C)
Rapid Freezing & Thawing Durability Factor (DF)	ASTM C 666 (Procedure A)	Minimum Durability Factor 90% at 300 cycles

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: U306-64-14.49 00

FEDERAL PROJECT NUMBER: NFA-2317(017)

FOR

SECTION 627

MODULAR EXPANSION JOINT SYSTEM

627.1-GENERAL:

627.1.1-Description: This work is the furnishing of material, services, labor, tools, equipment, and incidentals necessary to design, fabricate, inspect, test and install each fabrication, provision and installation of modular expansion joint system as indicated.

Each modular expansion joint system shall accommodate the movements and rotations as indicated

627.2 - WORKING DRAWINGS:

627.2.1 - Shop Drawings: The Contractor shall submit Shop Drawings and calculations delineating the expansion joint system details and outlining installation and waterproofing schemes to the Engineer for approval prior to fabrication of the joint. The Shop Drawings and calculations shall be prepared, sealed and signed by a registered Professional Engineer employed by the fabricator. These Shop Drawings shall include, but shall not be limited to, the following:

- A. Plan, elevation, and section of the joint system for each movement rating and roadway width. All dimensions and tolerances shall be specified.
- B. Sections showing all materials composing the expansion joint system with complete details of all individual components.
- C. All ASTM, AASHTO, or other material designations.
- D. Installation procedures including sequence, lifting mechanisms and locations, details of temporary anchorage during setting, temperature adjustment devices, opening dimensions relative to temperature, installation details at barriers, and seal installation details.
- E. Corrosion protection system.
- F. Requirements and details related to the temporary support of the joint system for shipping, handling, and job site storage.

- G. Design calculations for all structural elements including all springs and bearings. The design calculations shall include fatigue design for all structural elements, connections, and splices. All welded splices shall be shown on the Shop Drawings.
- H. Welding procedures shall be provided and shall be in accordance with the current AASHTO/AWS D1.SM/DI.F:2010 Bridge Welding Code.
- I. A written maintenance and part replacement plan to facilitate replacement of parts subject to wear. This plan shall include a list of parts, instructions for maintenance inspection, acceptable wear tolerances, methods for determining wear, procedures for replacing worn parts, and procedures for replacing seals.
- J. Any required modifications to blackout dimensions and reinforcing steel to accommodate the expansion joint system.

627.2.1.1-Certificates of Compliance:

- A. At the time of Shop Drawing submittal, the Contractor shall submit to the Engineer the following certifications for review:
 - 1. Fabricator's certificate of compliance with the AISC Quality Certification Program, Simple Bridge Category.
 - 2. Documentation that welding inspection personnel are qualified and certified as welding inspectors under AWS QC1, Standard for Qualification and Certification of Welding Inspectors.
- B. The Contractor shall submit to the Engineer the following test reports, certificates, and samples for review, within four weeks of the Shop Drawing approval:
 - 1. Fabricator's certificate of compliance for all polytetrafluoroethylene (PTFE) sheeting, PTFE fabric, and elastomer.
 - 2. Certified mill test reports for all steel and stainless steel in the expansion joint system assemblies.
 - 3. Certified test reports confirming that the springs and bearings meet the design load requirements.
- C. Acceptable Fabricators: Only fabricators whose modular expansion joint systems have met the fatigue resistance characterization requirements stipulated in Section 627.4.16.2.S of this Special Provision will be permitted to supply modular expansion joint systems. Any testing required to establish the fatigue resistance of all details of a specific proprietary system shall have been completed prior to submission of shop drawings. All fatigue testing shall have been conducted in accordance with Sections 627.4.16.3.1, 627.4.16.3.2 and 627.4.16.3.3 of this Special Provision.

The expansion joint fabricator shall have at least five years of experience in designing and manufacturing modular expansion joint systems. The Contractor shall provide written certification of the fabricator's experience to the Engineer. This certification shall include the location of each bridge, governmental agency/owner, and the name, address, and telephone number of each owner's/agency's representative.

627.2.1.2-Warranty: The Contractor shall provide a five-year written Manufacturer's Material warranty guaranteeing the performance and durability of the expansion joint system. Conditions constituting unsatisfactory performance and

durability include, but shall not be limited to, broken welds, or bolts, cracks in steel members, fatigue damage, loss of precompression in springs or bearings, debonded PTFE, breakdown of corrosion protection, and leakage. The Contractor shall replace or repair any expansion joint system component demonstrating unsatisfactory performance or durability within the five-year period commencing from the date of completion of the contract. All material and labor costs shall be paid by the Contractor.

627.3-MATERIALS:

Steel - AASHTO M270 Grade S0. Aluminum components shall not be used.

Stainless Steel - ASTM A240, Type 304

Polytetrafluoroethylene (PTFE) - The PTFE shall be virgin material in accordance with AASHTO LRFD Bridge Construction Specifications, 3rd Edition, with interims to 2016, Section 18.8.1, and the following properties:

Property	Test Method	Requirements
Ultimate Tensile Strength	ASTM D638	2800 psi
Ultimate Elongation	ASTM D638	200% min.
Specific Gravity	ASTM D792	2.10 min.
Melting Point	ASTM D4894	621°F \pm 18°F

Elastomeric Seals - Seals shall be continuous without splices. They shall meet the following physical property requirements.

Physical Properties	Test Method	Requirements
Hardness, Durometer A	ASTM D2240 modified	S0-60
Tensile Strength	ASTM D412	2,000 psi.
Elongation at Break	ASTM D412	2S0% min.
Compression Set @ 70 hrs. @ 212 °F	ASTM D39S, Method B	40% max.
Oven Aging, 70 hrs. @ 212°F	D-S73	
Tensile Strength, % decrease		20 max.
Elongation, % decrease		20 max.
Hardness, Type A Durometer, Points change		0 to +10 max.
Oil Swell, ASTM Oil No. 3, 70 hrs. @ 212° F Weight change, %	D-471	4S max.
Ozone Resistance 20% strain, 300 pphm in air Modified 70 hrs. @ 10S ° F	D1149 Modified	No cracks
Low Temperature Stiffening, 7 days @ -1S ° F Hardness, Type A Durometer, Points change	D-2240	0 to +1S
Low Temperature Test	D-746	Not brittle

The seal shall be a strip seal design and promote self-removal of foreign material during normal joint operation. The maximum permissible movement range for each seal is limited to 3.125 in.

Bolts, Nuts, Washers - AASHTO M 164, Type 1, galvanized in accordance with AASHTO M 298.

Grout - Non-shrink grout in accordance with Section 71S.S.

627.4-FABRICATION:

ADD THE FOLLOWING SUBSECTION 627.4.16:

627.4.16-Fabrication of Modular Expansion System:

627.4.16.1-General:

The expansion joint systems shall be fabricated consistent with the details, dimensions, material specifications, and procedures delineated in the approved Shop Drawings. All fabrication procedures shall be in conformance with the Standard Specifications and the Special Provisions.

All expansion joint systems shall be fabricated by the same fabricator.

Metallic attachments used to secure elastomeric seals to the centerbeams, if welded to the centerbeams and edge beams, shall be welded continuously along both their top and bottom edges.

Fabricate each modular expansion joint system as a single entity, extending continuously across the full width of the roadway, and up into the traffic barriers as indicated. Field splices will not be permitted in the modular expansion joint systems.

No bends or kinks are permitted in the modular joint system except as necessary to follow the roadway grade.

Anchors (headed studs and hook bars/stirrups) shall be inspected visually and tested in accordance with Section 7 of the AWS D1.S. Any anchor which does not have a complete end weld or does not meet these weld test requirements shall be replaced at the Contractor's expense.

The expansion joint system shall include a moveable plate system at each railing to match the shape of the adjacent concrete railing. The barrier joint system shall be fabricated of steel as defined in Section 627.3. The plates shall be designed to maintain freedom of movement that is continuous with the entire joint system. The system shall be secured.

627.4.16.1.1-PTFE Sliding Surfaces:

- A. All PTFE shall be bonded under controlled conditions and in strict accordance with written instructions provided by the PTFE fabricator.
- B. All PTFE surfaces shall be smooth and free of bubbles after completion of bonding operations.

627.4.16.1.2-Stainless Steel Sliding Surfaces:

- A. All stainless steel sliding surfaces shall have a surface finish of 20 micro inches (RMS) or less.
- B. Each stainless steel sheet shall be seal welded all around to the steel backing plate using the tungsten-arc welding process in accordance with current AWS specifications. The stainless steel sheet shall be

clamped to provide full contact with the steel backing plate during welding. The seal welds shall not protrude above the sliding surface of the stainless steel sheet.

627.4.16.1.3-Corrosion Protection:

- A. All steel surfaces, except those surfaces beneath stainless steel sheet, those to be bonded to PTFE, or those in direct contact with elastomeric seals, shall be hot-dip galvanized per AASHTO M 111.

627.4.16.1.4-Shipping and Handling:

- A. The expansion joint system shall be delivered to the job site and stored in accordance with the fabricator's written requirements as approved by the Engineer.
- B. Lifting locations, lifting mechanisms, and temperature setting devices shall be shown in the Shop Drawings. Lifting mechanisms, temperature setting devices, and construction adjustment devices shall not be welded to the centerbeams or edge beams.
- C. Damage to the expansion joint system during shipping or handling shall be just cause for rejection of the expansion joint system.
- D. Damage to the corrosion protection system shall be repaired to the satisfaction of the Engineer.

627.4.16.2-Design Requirements:

627.4.16.2.1-General:

- A. The expansion joint system shall be designed and detailed to permit access to the underside of the installed system for inspection and maintenance activities.
- B. The expansion joint system shall be designed and detailed to minimize concrete cracking above the support boxes. Measures taken shall include, but not be limited to, assuring adequate support box top plate thickness, specifying any additional deck slab steel reinforcement required, and providing adequate concrete cover.
- C. The expansion joint system and steel deck reinforcement shall be detailed to assure that adequate concrete consolidation can be achieved around all support boxes.
- D. The expansion joint seals shall not protrude above the top of the expansion joint system. Split extrusions may be used at upturns at all barriers.
- E. The elastomeric or urethane springs and bearings shall be designed to be removable and replaceable. The removal and reinstallation of the expansion joint seal shall be easily accomplished from above the joint. These operations shall be viable with one lane partial closure of the roadway.
- F. The expansion joint system shall be designed and detailed to be watertight.
- G. The expansion joint system shall be designed and detailed to account for the effects of all translations, in addition to the superelevation and longitudinal profile of the roadway.

627.4.16.2.2-Design Axle Loads and Impact Factors:

- A. The centerbeams, support bars, bearings, connections, and other structural components shall be designed for the simultaneous application of vertical and horizontal loads from a tandem axle. The tandem axle shall consist of a pair of axles spaced 4 ft. apart with vertical and horizontal loads as specified in Sections 627.4.16.2.2 B, C, D, and E of this Special Provision. The transverse spacing of the wheels shall be 6 ft. The distribution of the wheel load among centerbeams shall be as stipulated in Section 627.4.16.2.3 of this Special Provision.
- B. The vertical load range for fatigue design shall be 32 kips tandem. This tandem shall be taken as two 16 kips axles spaced 4 ft. apart. Only one of these tandem axles must be considered in the design, unless the joint opening exceeds 4 ft. The load range shall be increased by the dynamic load allowance (Impact Factor) of 75%. Load factors shall be applied in accordance with Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition.
- C. The vertical load for strength design shall be a 50 kips tandem. This tandem shall be taken as two 25 kips axles spaced 4 ft. apart. Only one of these tandem axles must be considered in the design, unless the joint opening exceeds 4 ft. This load shall be increased by the dynamic load allowance (Impact Factor) of 75%. Load factors shall be applied in accordance with Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition.
- D. The horizontal load range for fatigue design shall be 20% of the amplified vertical load range (LL+IM) specified in Section 627.4.16.2.2B of this Special Provision. For modular expansion joint systems installed at locations where significant braking and/or acceleration forces are expected, the horizontal load range for fatigue design shall be 50% of the amplified vertical load range (LL + IM).
For modular expansion joint systems installed on vertical grades in excess of 5%, the horizontal component of the amplified vertical load range (LL+IM) specified in Section 627.4.16.2.2B of this Special Provision shall be added to this horizontal load range.
- E. The horizontal load for strength design shall be 20% of the amplified vertical load (LL+IM) specified in Section 627.4.16.2.2C of this Special Provision. For modular expansion joint systems installed at locations where significant braking and/or acceleration forces are expected, the horizontal load for strength design shall be 50% of the amplified vertical load (LL + IM).
For modular expansion joint systems installed on vertical grades in excess of 5%, the horizontal component of the amplified vertical load (LL+IM) specified in Section 627.4.16.2.2C of this Special Provision shall be added to this horizontal load.

627.4.16.2.3-Distribution of Wheel Loads:

The following table specifies the centerbeam distribution factor as a function of centerbeam top flange width. This factor is the percentage of the design vertical axle load and the design horizontal axle load which shall be applied to an individual centerbeam for the design of that centerbeam and its associated support bars. Distribution factors shall be interpolated for centerbeam top flange widths between those explicitly denoted in the table. In no case shall the distribution factor be taken as less than 50%. The remainder of the load shall be divided equally and applied to the two adjacent centerbeams or edge beams.

Width of Centerbeam Top Flange	Distribution Factor
2.5 in.	50%
3.0 in.	60%
4.0 in.	70%
4.5 in.	80%

627.4.16.2.4 - Fatigue Limit State Design Requirements:

- A. Modular expansion joint system structural members, connections (bolted and welded), splices, and attachments shall be designed to resist the Fatigue Limit State load combination specified in Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition. The vertical and horizontal load ranges specified in Section 627.4.16.2.2 of this Special Provision shall be applied simultaneously. These loads shall be distributed as specified in Section 627.4.16.2.3 of this Special Provision.
- B. The nominal stress ranges, σ_f , at all fatigue critical details shall be obtained from a structural analysis of the expansion joint system applying the design vertical and horizontal load ranges specified in Section 627.4.16.2.2 of this Special Provision, and distributed as specified in Section 627.4.16.2.3 of this Special Provision.

The expansion joint system shall be analyzed with a minimum gap opening corresponding to the midrange configuration (at least half of the maximum gap opening). The design axle load shall be applied as two wheel loads, each having a transverse width of 20 in. For each detail under consideration, the wheel loads shall be positioned transversely on a centerbeam to achieve the maximum nominal stress range at that detail. The vertical and horizontal wheel loads shall be applied as line loads to the top of the centerbeams at their centerlines.

The design stress range in the centerbeam-to-support bar connection shall be calculated according to Sections 1 and 2 below. The design nominal stress ranges, σ_f , shall be used for fatigue design as specified in Section 627.4.16.2.4C of this Special Provision.

1. Welded or Bolted Single-Support Bar Systems

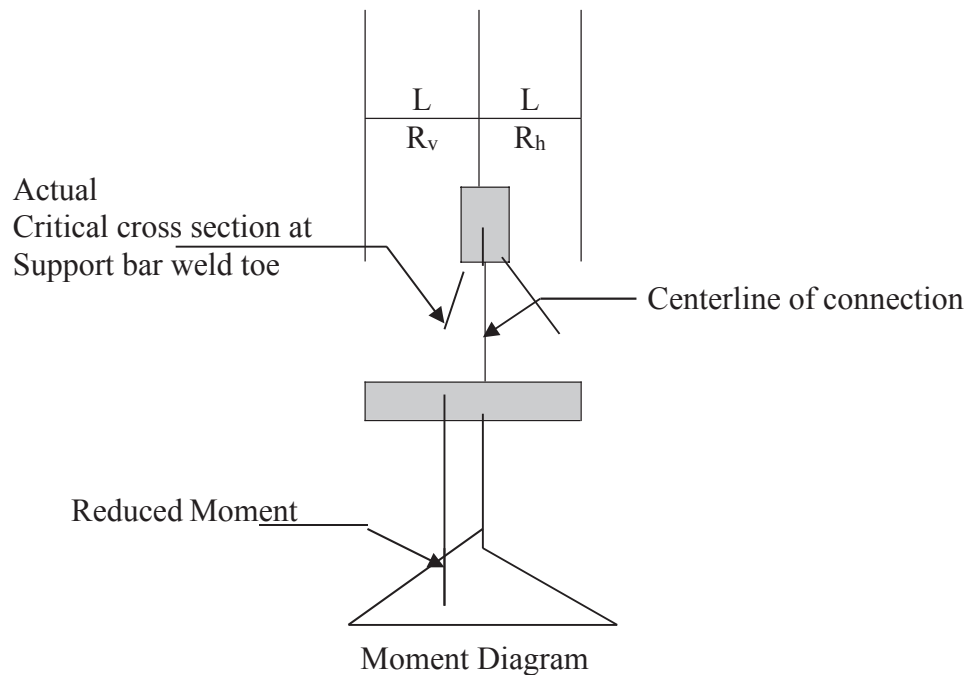
- a) The nominal stress range, σ_f , in the centerbeam at a welded or bolted stirrup shall be the sum of the longitudinal bending stress ranges at the critical section resulting from vertical and

horizontal loading. The effects of stresses in any load-bearing attachments such as the stirrup or yoke shall not be considered when calculating the longitudinal stress range in the centerbeam. For bolted single-support-bar systems, stress ranges shall be calculated using the net section.

- b) The nominal stress range, $\otimes f$, in the stirrup or yoke shall be calculated without considering the effects of stresses in the centerbeam. The stress range shall be calculated by assuming a load range in the stirrup equal to 30% of the total vertical reaction force between the centerbeam and the support bar. The effects of horizontal loads may be neglected in the design of the stirrup.

2. Welded Multiple-Support Bar Systems

Three locations have been identified as initiation sites for fatigue cracking at a centerbeam-to-support bar welded connection. The types of cracking associated with these three locations are described below. The corresponding equations may be used to calculate the nominal stress range, $\otimes f$. For the support bar, either the reduced moment at the critical cross section or the moment at the centerline of the connection may be used in these equations.



- a) Centerbeam weld toe cracking is driven by a combination of vertical and horizontal (longitudinal) bending stress range, S_{RB} ,

in the centerbeam, and vertical stress range, S_{RZ} , at the top of the connection weld.

The vertical and horizontal (longitudinal) bending stress range, S_{RB} , at the bottom of the centerbeam shall be calculated as:

$$S_{RB} = \frac{M_{Vcb}}{S_{xcb}} + \frac{M_{Hcb}}{S_{ycb}}$$

The vertical stress range, S_{RZ} , at the top of the connection weld shall be calculated as:

$$S_{RZ} = \frac{R_H D_{cb}}{S_{wtop}} + \frac{R_V}{A_{wtop}}$$

- b) Support bar weld toe cracking is driven by a combination of vertical and horizontal (longitudinal) bending stress range, S_{RB} , in the support bar and vertical stress range, S_{RZ} , at the bottom of the connection weld.

The vertical and horizontal (longitudinal) bending stress range, S_{RB} , at the top of the support bar shall be calculated as:

$$S_{RB} = \frac{M_{Vsb}}{S_{xsb}} + \frac{1}{2} \frac{R_H (D_{cb} + H_w + 0.5D_{sb})}{S_{xsb}}$$

The vertical stress range, S_{RZ} , at bottom of the connection weld shall be calculated as:

$$S_{RZ} = \frac{R_H (D_{cb} + H_w)}{S_{wbot}} + \frac{R_V}{A_{wbot}}$$

- c) Weld throat cracking is driven by a vertical stress range at the weld throat.

The vertical stress range, S_{RZ} , at mid-height of the connection weld shall be calculated as:

$$S_{RZ} = \frac{R_V}{A_{wmid}} + \frac{R_H (D_{cb} + H_w)}{S_{wmid}}$$

In the above equations:

R_V		Vertical reaction at the connection weld
R_H		Horizontal reaction at the connection weld
M_{Vcb}		Bending moment in the centerbeam due to applied vertical
M_{Hcb}		Bending moment in the centerbeam due to applied horizontal
M_{Vsb}		Bending moment in the support bar due to applied vertical
S_{xcb}		Section modulus at bottom of the centerbeam about horizontal
S_{ycb}		Section modulus of the centerbeam about vertical axis
S_{xsb}		Section modulus at top of the support bar about horizontal

A_{wtop}		Area of the weld at the top of the connection
A_{wmid}		Area of the weld at the middle of the connection
A_{wbot}		Area of the weld at the bottom of the connection
S_{wtop}		Section modulus of the weld at the top of the connection
S_{wmid}		Section modulus of the weld at the middle of the connection
S_{wbot}		Section of the modulus of the weld at the bottom of the connection
H_w		Height of the weld
D_{cb}		Depth of the centerbeam
D_{sb}		Depth of the support bar

The nominal stress range, $\otimes f$, at welded multiple-support-bar connection details shall be calculated for each case above as follows:

$$\text{where: } \otimes f = \sqrt{S_{RB}^2 + S_{RZ}^2}$$

S_{RB} vertical and horizontal (longitudinal) stress range in the centerbeam or support bar, as calculated for each specific case above

S_{RZ} vertical stress range in the centerbeam-to-support bar connection

weld, as calculated for each specific case above

- C. To ensure an infinite fatigue life, all modular expansion joint system structural members, connections (bolted and welded), splices, and attachments shall satisfy the following:

$$\otimes f \leq \frac{F_{TH}}{2}$$

where:

$\otimes f$ the nominal stress range as specified in Section 627.4.16.2.4 B of this Special Provision

F_{TH} constant amplitude fatigue threshold (CAFL) as specified in Section 627.4.16.2.S of this Special Provision

627.4.16.2.5-Fatigue Resistance of Details: The fatigue resistance of details shall be characterized in terms of the fatigue categories specified in Table 6.6.1.2.S-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition. Many details composing modular expansion joint systems may clearly correspond to specific structural details depicted in Figure 6.6.1.2.3-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition. In these cases, the applicable fatigue categories specified in Table 6.6.1.2.S-1 may be used for design. In cases where a detail does not clearly correspond to a structural detail depicted in Figure 6.6.1.2.3-1, fatigue testing shall be conducted, in accordance with Sections 627.4.16.3.1 through 627.4.16.3.3 of

this Special Provision, to establish the appropriate constant amplitude fatigue limit (CAFL) for that detail.

627.4.16.2.6-Strength-I Limit State Design Requirements: Modular expansion joint system structural steel members, connections (bolted and welded), splices, and attachments shall be designed to resist the Strength-I Limit State load combination specified in Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition. The vertical and horizontal loads specified in Section 627.4.16.2.2 of this Special Provision shall be applied simultaneously. These loads shall be distributed as specified in Section 627.4.16.2.3 of this Special Provision.

627.4.16.3-FATIGUE TESTING REQUIREMENTS:

627.4.16.3.1-Fatigue Testing of Metallic Structural Components and Connections:

A. Methodology

1. This test procedure is acceptable for, and specifically applicable to, establishing the fatigue resistance of the centerbeam-to-support bar connection in modular expansion joint systems. It is applicable to single-support-bar and multiple-support bar systems having either welded or bolted centerbeam-to-support bar connections. The same methodology may be applied to establish the fatigue resistance of other modular expansion joint metallic structural component details, including centerbeam splices.
2. Each fatigue test generates a discrete datum. Each datum comprises an applied constant amplitude nominal stress range, S_r , and the corresponding number of cycles, N , associated with either a predetermined extent of crack propagation, defined as failure, or with termination of the test, defined as runout. Ten reportable fatigue cracks (data) shall be acquired for each connection detail. All data shall be in the very long life range, corresponding as closely to the constant amplitude fatigue limit (CAFL) as practical. Specifically, the number of cycles, N , associated with each datum, shall be no less than one order of magnitude less than N_{min} corresponding to the detail category specific CAFL specified in Section 627.4.16.3.1G.1 of this Special Provision. For example, to characterize a detail as Detail Category C, the tested number of cycles, N , shall exceed 4.4×10^8 for each datum.
3. The constant amplitude nominal stress range shall be calculated at the anticipated initiation location of an incipient crack. Nominal stresses shall be calculated using conventional equations for analyzing bending and axial load. These equations are essentially the same as those used in strength design. The stress concentration effects of a weld, bolt hole, or other local features are not explicitly embodied in the conventional nominal stress equations.
4. The appropriate AASHTO detail category applicable to fatigue design shall be established by comparing acquired test data to fatigue resistance graphs representing the AASHTO detail categories. The constant amplitude fatigue limit (CAFL) applicable to fatigue design corresponds

to the AASHTO detail category fatigue resistance graph representing a lower bound of the experimentally acquired data.

- S. When testing is conducted exclusively in the infinite life regime and more stringent test data scatter requirements are satisfied, a unique CAFL (different from those CAFL corresponding to specific detail categories specified by AASHTO) may be established for fatigue design.

B. Specimens

1. Specimens selected for testing shall be full-scale centerbeam and support bar assemblies or subassemblies representative of those installed in field applications. A subassembly is defined as a specimen having the same physical and geometric properties as an assembly but having a reduced number of centerbeams.
2. Each specimen shall consist of three continuous centerbeam spans over four equally spaced support bars. Centerbeam spans between adjacent support bar centerlines shall be a minimum of 3.0 ft. and a maximum of 4.0 ft. Support bar spans shall be a minimum of 3.0 ft. and a maximum of 3.67 ft. The centerbeam-to-support bar connection being tested shall be located at the midspan of each support bar.
3. Any welded or bolted attachments used to secure equidistant springs to a support bar, centerbeam, or stirrup shall be fabricated as an integral part of the specimen. A load path (rigid support fixed to the test fixture) shall be provided to resist any horizontal forces or displacements which would normally be resisted through these attachments in a field installation. Any miscellaneous welded or bolted attachments, including welded attachments used to secure the expansion joint elastomeric seals to the centerbeams, shall also be fabricated as integral parts of the specimen.
4. Support bars of subassembly specimens that are components of single-support-bar swivel-joist type modular expansion joint systems shall be oriented perpendicular to the longitudinal axis of the centerbeam.
- S. Prior to testing, each specimen shall be visually inspected for any defects, loose fasteners or other aberrations which could affect the tested fatigue resistance. Defects and flaws shall be defined in accordance with the appropriate governing specification (ASTM A-6, AWS D1.S, etc.). Data acquired from specimens containing such defects shall not be excluded from consideration except as permitted in Section 627.4.16.3.1G.2.c of this Special Provision. Any observed defect shall also be reported with its corresponding data in the tabular format stipulated in Section 627.4.16.3.1H of this Special Provision.

C. Instrumentation

1. Each specimen shall be sufficiently instrumented to measure the static nominal strain range within that specimen for a specific applied load range. Best results can generally be obtained when the applied load range for the static calibration tests does not pass through zero load. Strain measurements shall be made at locations sufficiently distant from local effects, such as weld toes or bolt holes, which could significantly influence acquired test data.
2. As a minimum, eight strain gages shall be installed on the centerbeam top flange in the vicinity of each centerbeam-to-support bar connection. These

gages shall be installed in pairs on each side of the connection at distances of one and two times the depth of the centerbeam from the centerline of the connection. Each pair of strain gages shall be located symmetrically about the centerline of the centerbeam. As a minimum, two strain gages shall also be installed on the support bar bottom flange in the vicinity of each centerbeam-to-support bar connection. One of these strain gages shall be installed on each side of the connection at a distance equal to the depth of the support bar from the centerline of the connection. These strain gages shall be installed along the centerline of the support bar.

D. Test Fixtures

1. Test fixtures shall have the capability to adequately support and secure the specimen throughout the duration of the test. The fixture shall be designed and fabricated to such tolerances as required to assure that additional stresses will not be generated in the specimen as a consequence of fixture misalignment. Mismatches resulting from specimen fabrication errors shall be accommodated by shimming or other such means precluding the application of force to the specimen.
2. Typical elastomeric bearings and springs used to transfer vertical loads from the support bars to the support boxes may be replaced with steel bearings in the test fixture. This modification will enable fatigue testing at higher load ranges and different frequencies than those encountered during normal service conditions.
3. Load shall be applied through two 10 in. long patches. Each patch shall typically comprise a steel plate and a hard rubber bearing pad placed in contact with the bottom flange of the centerbeam. Each patch shall be located at the midspan of each outer span.
4. In order to assure adequate seating of the specimen in the test fixture, a minimum of 10 kips shall be applied at each patch location. This requirement is waived for tests of single support bar systems conducted using load reversal. Once this load has been applied, all strain measuring devices shall be rebalanced to zero strain while the preload is maintained. An additional load approximately equivalent to the calculated load range shall be applied. Strain ranges shall be measured for the load range from 10 kips to the peak load. Each static calibration test shall be repeated three times while still maintaining a minimum 10 kips load at each load patch. The measured strain ranges from each repetition should vary by no more than 2S% from the mean value. If the stress ranges are not repeatable, appropriate modifications shall be made to the test fixture until the strain ranges are repeatable.

E. Static Calibration Test

1. Prior to any fatigue resistance testing, a static calibration test shall be performed in order to validate the structural analysis model. The static calibration test shall be performed after attainment of stress range repeatability as described in Section 627.4.16.3.1D.4 of this Special Provision. The structural analysis model shall be considered validated when calculated strain ranges are within $\pm 2S\%$ of the measured strain ranges at every strain gage location.

2. For the purpose of reporting nominal fatigue resistance stress ranges at specific details, stress ranges determined through structural analysis of the model shall be preferred over stress ranges acquired directly from test measurements.

F. Test Procedures

1. A minimum of ten data points shall be required to establish the fatigue resistance of each detail. The centerbeam-to-support bar connection shall be considered as a single detail.
2. Several data points may be obtained from a single specimen by repairing the cracked sections of that specimen and resuming testing. Such repairs shall have minimal effect on the stress ranges at unfailed details still being tested. Data points derived from tests in which a repaired detail cracks again shall be discarded.
3. All data shall be in the very long life range, corresponding as closely to the constant amplitude fatigue limit as practical, but in no case less than 200,000 cycles. Either finite life regime or infinite life regime testing may be conducted. For infinite life regime testing, the number of cycles, N , associated with each of the ten data shall be at least twice the number of cycles, N_{min} , designated in the table in Section 627.4.16.3.1G.1 of this Special Provision.
4. Loads shall be applied using hydraulic actuators or other similar loading devices. The magnitude of the vertical load range, $\otimes P_v$, shall be maintained and continuously monitored throughout the duration of the test. Vertical and horizontal load ranges shall be applied to the specimen simultaneously. The horizontal load range shall always be equal to 20% of the vertical load range, $\otimes P_v$. This horizontal-to-vertical load ratio may be obtained by inclining the specimen 11.3 degrees with respect to the horizontal plane and applying load through vertically oriented actuators.
5. For multiple support bar systems, the loading mechanism shall be either exclusively tension or exclusively compression and shall be applied at a constant amplitude at any desired frequency. The applied load range shall be in a direction such that the reaction force between the centerbeam and support is always tensile. The load range shall not pass through zero load. Minimum preload shall be maintained throughout the duration of the test.
6. Single support bar systems may be loaded using the same procedures as those for multiple support bar systems. If premature stirrup failure occurs, an applied load range of 70% downward and 30% uplift may be used.
7. The load ranges used in the test shall not be so large as to alter the observed failure mode from that which would be observed under service conditions. Under no circumstance shall imposed stress exceed the yield stress of the material in any portion of the specimen. Each specimen shall be tested using at least two different load (stress) ranges.
8. If infinite life regime testing is conducted, the first load range should be chosen so that the applied stress range is just above the postulated CAFL. The load range in the subsequent test shall be decreased if failure resulted and increased if the test resulted in a runout. A suggested increment in load is such that the stress range is increased or decreased by 2 ksi. The

applicable CAFL must be selected from those CAFL values corresponding to the AASHTO fatigue categories. The selected CAFL is the one just below the lowest stress range that resulted in cracking.

9. The following criteria shall be used to define failure of a given centerbeam-to-support bar connection:

- a. Welded Centerbeam-to-Support Bar Connections

- i. *Centerbeam weld toe cracking* originates at or near the centerbeam weld toe, propagates up into the centerbeam at some angle, and grows back over the connection. These cracks typically grow at an angle of about 45 degrees. A specimen shall be considered as failed due to this type of cracking when the crack has grown on any vertical face a length from the point of origin equal to half of the centerbeam depth.
- ii. *Support bar weld toe cracking* originates at or near the support bar weld toe, propagates down into the support bar, and grows back under the connection at some angle, typically about 45 degrees. A specimen shall be considered as failed due to this type of cracking when the crack has grown on any vertical support bar face a length from the point of origin equal to half of the depth of the support bar.
- iii. *Weld throat cracking* originates in the weld throat and typically grows in a plane parallel to the longitudinal axis of the support bar at about mid-depth of the weld throat. A specimen shall be considered as failed due to this type of cracking when a complete fracture of the weld throat has occurred. These cracks have been observed to turn down into the support bar, but only after significant growth. In such instances, the criteria for support bar weld toe cracking shall be applied.

- b. Welded Stirrup Connections

A specimen shall be considered as failed when cracks result in the complete fracture of any stirrup leg, or when cracks originating at or near a stirrup weld have grown into any face of the centerbeam a length from the stirrup weld toe equal to half of the centerbeam depth.

- c. Bolted Centerbeam-to-Support Bar Connections

A specimen shall be considered as failed when:

- i. Fatigue cracks which have grown out of a bolt hole have resulted in the complete fracture of the tension flange of the centerbeam.
- ii. Fatigue cracks which have grown out of a bolt hole have extended into any face of the centerbeam web a distance equivalent to half of the centerbeam depth less the centerbeam flange thickness.
- iii. Any portion of a stirrup fractures completely.
- iv. Any single bolt fractures completely.

10. Alternate Criteria for Termination of a Finite Life Regime Test

A test may also be terminated when, for a given stress range, the specimen has survived the number of cycles required to plot the data above either a particular fatigue resistance curve or the maximum permitted in Section 627.4.16.2.1G.2.d of this Special Provision. For example, if the applied stress range is 17 ksi and the desired fatigue resistance curve is Category C, then

based upon the equation presented in Section 627.4.16.2.1G.1 of this Special Provision, the test may be terminated after application of about 900,000 cycles provided that the specimen has not failed based on the above described criteria.

11. Nominal Stress Range Calculation

a. Welded Centerbeam-to-Support Bar Systems

- i.* The nominal stress range for centerbeam weld toe cracking shall be calculated by taking the square root of the sum of the squares of the horizontal bending stress range in the centerbeam and the vertical stress range at the top of the weld.
- ii.* The nominal stress range for support bar weld toe cracking shall be calculated by taking the square root of the sum of the squares of the longitudinal bending stress range in the support bar and the vertical stress range at the bottom of the weld.
- iii.* The nominal stress range for weld throat cracking shall be the calculated vertical stress range in the throat of the weld.
- iv.* The nominal stress range in the centerbeam at a welded stirrup shall be calculated as the summation of the longitudinal bending stress ranges at the critical section resulting from vertical and horizontal loading. The entire load range shall be used in the calculation, even if the loading is partly in compression. The effects of stresses in any load-bearing attachments such as the stirrup or yoke shall not be considered when calculating the nominal stress range in the centerbeam. The load range in the stirrup itself shall be taken as 30% of the total vertical load range carried through the connection. The effect of horizontal forces may be neglected.

b. Bolted Systems

- i.* The nominal stress range in the centerbeam shall be taken as the summation of the longitudinal bending stress ranges in the centerbeam resulting from vertical and horizontal loading. Nominal stress ranges shall be calculated using the net section. The effects of stresses in the stirrup shall not be considered when calculating the nominal stress range in the centerbeam.
- ii.* The nominal load range in the bolt group and the stirrup assembly shall be taken as 30% of the total vertical load range carried through the connection. The effect of horizontal forces may be neglected.

G. Interpretation of Test Data

1. The experimentally acquired data (cycles to failure, N , and applied constant-amplitude nominal stress range, S_r) and graphs representing the fatigue resistance of the detail categories delineated in Section 6.6 of the AASHTO LRFD Bridge Design Specifications - Third Edition shall be plotted on a log-log scale. The data are associated with the greatest S-N curve which represents a lower bound to the data. The equation representing the finite life fatigue resistance of these AASHTO detail categories is:

$$N = \left(\frac{A}{S_{r,eff}} \right)^3$$

where:

N number of cycles to failure

$S_{r,eff}$ nominal effective stress range at the detail under consideration

A constant defined in Table 6.6.1.2.S-1 of the AASHTO LRFD Bridge Design Specifications - Third Edition

The minimum number of cycles associated with infinite fatigue life, N_{min} , and the corresponding constant amplitude fatigue limit (CAFL) for each AASHTO detail category is designated in the table below.

Detail Category	N_{min} (infinite fatigue life)	CAFL (ksi)
A	1.8×10^6 cycles	24.0
B	3.0×10^6 cycles	16.0
B'	3.5×10^6 cycles	12.0
C	4.4×10^6 cycles	10.0
C'	2.5×10^6 cycles	12.0
D	6.4×10^6 cycles	7.0
E	1.2×10^7 cycles	4.5
E'	2.2×10^7 cycles	2.6

2. Finite Life Regime Testing

- The number of cycles, N, to either failure or runout, associated with each of the ten data need not exceed N_{min} , designated in the table in Section 627.4.16.3.1G.1 of this Special Provision.
- The detail category applicable to fatigue design shall be that corresponding to the highest of the AASHTO detail category fatigue resistance graphs representing a lower bound of all ten experimentally acquired data, except as limited in the table in Section 627.4.16.3.1G.2.d.
- If all but one data point falls above a selected AASHTO S-N curve, that one data point may be discarded and replaced by three new data obtained through additional testing. The additional testing shall be conducted using the same stress range as that of the discarded datum. The three additional data shall be plotted along with the remaining nine data. The applicable detail category shall be that corresponding to the highest of the AASHTO detail category fatigue resistance graphs representing a lower bound of all twelve data, except as limited in the table in Section 627.4.16.3.1G.2.d. For any detail, only one data may be discarded and subsequently replaced three additional data for any set of ten original data. None of the additional data, if obtained, shall be discarded.
- The maximum fatigue resistance of any detail shall not exceed that associated with the fatigue category prescribed in the table below.

Type of Detail	Maximum Permitted Category ³
Welded Multiple Centerbeam-to-Support Bar Connections	C
Welded Stirrup Attachments for Single Support Bar Systems	B
Bolted Stirrup Attachments for Single Support Bar Systems	D
Groove Welded Centerbeam Splices ¹	C
Miscellaneous Welded Connections ²	C
Miscellaneous Bolted Connections	D

Footnotes:

1. Groove-welded full-penetration splices may be increased to Category B if weld integrity is verified using non-destructive testing (NDT).
2. Miscellaneous connections include attachments for equidistant devices.
3. The maximum permitted category applies only to the S-N curve at stress ranges above the CAFL. A CAFL that is higher than the CAFL associated with these categories may be used if the CAFL is established with a minimum of ten test data.
 - e. The fatigue resistance for stirrups welded to a centerbeam flange shall not be taken greater than that defined using the fatigue details defined in Section 6.6 of the AASHTO LRFD Bridge Design Specifications- Third Edition. The fatigue resistance of the centerbeam is similar to and shall be considered as a "Longitudinally Loaded Groove-Welded Attachment" or a "Longitudinally Loaded Fillet-Welded Attachment", depending on the type of connection used. The fatigue resistance of the stirrup is similar to and shall be considered as a "Transversely Loaded Groove-Welded Attachment" or a "Transversely Loaded Fillet-Welded Attachment", depending on the type of connection used.
3. Infinite Life Regime Testing
 - a. The applicable constant amplitude fatigue limit (CAFL) for fatigue design may be selected as the highest CAFL of the AASHTO detail categories representing a lower bound to the experimentally acquired data. The CAFL of the AASHTO detail categories are designated in the table in Section 627.4.16.3.1G.1 of this Special Provision.
 - b. A unique CAFL (different from the CAFL categories delineated in Section 6.6 of the AASHTO LRFD Bridge Design Specifications - Third Edition) may be established if all ten data are within 4 ksi of that unique CAFL.

H. Data Reporting

1. Fatigue Test Results and Observations

Data shall be reported in the typical S-N format (logarithm(S) vs. logarithm(N)) with the log of the stress range plotted as the ordinate (y-axis). Additionally, the data shall be reported in tabular format. The table shall contain the following information:

- a. Nominal stress range at the specific detail, $S_{r,eff}$
- b. Applied load range for each patch

- c. Number of cycles at initial observation of cracking (for reporting purposes only, not included as S-N data)
- d. Number of cycles at failure or termination of the test, N, and the reason for stopping the test (failure or termination)
- e. Type of crack as described in Section 627.4.16.3.1F.9 of this Special Provision. A detailed description of the fatigue crack shall be provided if the observed crack does not resemble any of the crack types described in Section 627.4.16.3.1F.9 of this Special Provision

2. Miscellaneous Required Information

The following information shall also be reported:

- a. Expansion joint system type and fabricator
- b. Drawing depicting shape, size, and dimensions of the specimen
- c. Drawings depicting fixture details, including specimen orientation
- d. Section properties and dimension of the centerbeam and support bar
- e. Centerbeam-to-support bar connection details
 - i. Weld procedure specifications for welded expansion joint systems
 - ii. Bolt size, material specifications, location, and method of tightening for bolted expansion joint systems.

627.4.16.3.2-Durability Testing of Elastomeric Support Bearings:

A. Scope

1. This section provides guidelines for durability testing of the elastomeric support bearings typically used in modular expansion joint systems. It is not applicable to compression springs, equidistant springs, or other elastomeric components.
2. Tests shall be performed dynamically on individual bearings. Fatigue life is evaluated by applying a displacement range to each specimen rather than a load or stress range.

B. Specimens

1. Specimens shall comprise full-scale bearing components representative of those installed in field applications. PTFE sliding surfaces or materials typically bonded to the elastomeric support bearings shall be fabricated as an integral part of the specimen.
2. Prior to testing, each specimen shall be visually inspected for any flaws or defects that could plausibly affect fatigue resistance. Any flaws or details shall be defined and recorded. Data obtained from specimens containing such anomalies shall not be excluded from the data set. Observed anomalies shall also be reported with the test data.

C. Test Fixtures

Test fixtures shall have the capability to adequately support and secure the specimen throughout the duration of the test. The fixture shall be designed and fabricated to such tolerances as required to assure that additional stresses will not be generated in the specimen as a consequence of fixture misalignment.

D. Loading Details

1. Loads shall be applied through hydraulic actuators or other similar loading devices. Fatigue testing shall be performed using displacement control. Displacement and load ranges shall be continuously monitored throughout the duration of the fatigue test to assure that desired displacement range and minimum preload are maintained.
2. Load shall be applied to the specimen through flat steel plates that are smooth and free of surface corrosion. These plates shall be sufficiently thick to assure even load distribution to the specimen.

E. Dynamic Stiffness Test

1. Testing shall be conducted on each specimen to be subjected to fatigue testing in order to establish its dynamic stiffness for at least three different loading frequencies. The maximum of these loading frequencies shall be equal to the service load frequency corresponding to a vehicle traveling at 60 mph. The loading frequency, f , shall be calculated as:

$$f = \frac{V}{2(g + b)}$$

where:

V vehicle speed (60 mph at service load)

g centerbeam gap (assume mid-range configuration)

b centerbeam width

2. The load range applied during the dynamic stiffness test shall be that obtained from structural analysis using fatigue wheel loads and wheel load distribution factors as specified in Section 627.4.16.2.2 and Section 627.4.16.2.3 of this Special Provision.
3. Each dynamic stiffness test shall be performed three times. Data from individual tests shall be compared to assure consistency of test results.

F. Fatigue Test

1. A minimum of three fatigue tests shall be required to establish the durability of each type of bearing.
2. The fatigue test shall be conducted using displacement control. The displacement (strain) range shall be applied using a sine or other smooth waveform at any frequency less than or equal to the service load frequency calculated in Section 627.4.16.3.2E of this Special Provision. The magnitude of the applied displacement amplitude, Δ , shall be calculated as:

$$\Delta = \frac{R_v}{K}$$

where:

R_v vertical reaction force at the support bearing as obtained from structural analysis

K dynamic stiffness of the support bearing as determined in Section 627.4.16.3.2E of this Special Provision.

3. A minimum precompression strain shall be maintained in the specimen throughout the duration of the test. This precompression strain shall be approximately equal to that present in a support bearing in a field installation. The magnitude of the applied cyclic strain shall be at least equal to the precompression strain.

4. The minimum and maximum dynamic load shall be recorded at the beginning of the test. The minimum and maximum dynamic load shall be monitored and periodically recorded throughout the duration of the test.
5. At the end of each applied displacement cycle, the displacement shall be held at the precompression level for no less than one half of the period of loading in order to facilitate heat dissipation. Artificial air flow devices (electrical fans) may be used to assist heat dissipation. Excessive heat generation will adversely affect the tested fatigue life.
6. A specimen shall be accepted as having passed the fatigue test criteria after withstanding 2 million cycles of loading without failure.
7. The following criteria shall constitute failure:
 - a. The elastomeric material exhibits excessive deterioration or cracking.
 - b. The measured minimum dynamic load falls to 30% of the initial dynamic load recorded at test initiation.
 - c. The measured dynamic load range decreased to half of the initial dynamic load range recorded at test initiation.
- G. Data Reporting for Fatigue Test
 1. Data shall be reported in tabular format and shall contain the following information for each specimen tested:
 - a. Minimum (precompression) strain, maximum strain, displacement, and load at test initiation
 - b. Type of loading impulse (sine wave, ramp, etc.)
 - c. Number of cycles at initial observation of distress leading to failure (for reporting purposes only, not to be included in the data)
 - d. Number of cycles at failure
 - e. A description of the mode of failure
 2. The following data shall also be reported for each specimen tested:
 - a. Bearing type and fabricator
 - b. Drawings depicting shape, size, and dimensions of the specimen including any PTFE sliding surfaces or materials bonded to the specimen
 - c. Drawings depicting fixture details, including specimen orientation

627.6.9-Installation:

The fabricator of the expansion joint system shall provide a qualified installation technician to be on site during installation of the expansion joint devices to assure their proper installation. This technician shall be a full time employee of the fabricator of the specific expansion joint system being installed. The Contractor shall comply with all recommendations made by the expansion joint fabricator's installation technician as approved by the Engineer. Each expansion joint system fabricator's installation technician shall certify to the Engineer that the approved installation procedures were followed. All certifications to the Engineer shall be in writing and shall be signed and dated by the fabricator's installation technician.

Each expansion joint system shall be installed in strict accordance with the fabricator's approved Shop Drawings, the Contract Drawings, and the recommendations of the fabricator's installation technician.

Each permanently installed expansion joint system shall match exactly the finished roadway profile and grades. In order to perform the work of installing the

joint system in a proper manner, some portions of the slab, barrier and abutment cannot be constructed until after the joint system is installed. Once the expansion joint system has been installed to the proper profile and grade, install non-shrink grout under all support boxes in accordance with the grout fabricator's recommendations.

Each expansion joint system shall be tested for watertightness after installation in accordance with Section 627.6.9.1 of this Special Provision. Leaks shall be repaired to the satisfaction of the Engineer.

The Contractor shall exercise care at all times to protect each expansion joint system from damage. The Contractor shall protect concrete blockouts and supporting systems from damage and construction traffic prior to installation of the expansion joint systems. After installation, construction loads shall not be allowed on the expansion joint systems. The Contractor shall submit to the Engineer for approval a proposed method of bridging over each expansion joint system to accommodate any construction traffic.

Each expansion joint system shall be set to a gap width corresponding to the ambient temperature at the time of setting. This information is specified in the Contract Drawings and shall also be specified on the approved Shop Drawings. Any mechanical devices supplied by the joint system fabricator, for the purpose of setting the expansion joint system to the proper gap width, will remain the property of the fabricator. When no longer required, the devices shall be returned to the fabricator.

All forms and debris that may impede movement of the expansion joint systems shall be removed.

627.6.9.1-Watertightness: The Contractor shall flood each completely installed expansion joint system to a minimum depth of 3 in. for a duration of at least one hour. If leakage is observed, the expansion joint system shall be repaired at the Contractor's expense. The repair procedure shall be prepared by the expansion joint system fabricator and shall be submitted to the Engineer for approval. After repairs are completed, the expansion joint shall be retested for leakage.

627.6.9.2-Inspection: Each expansion joint system shall be subjected to and shall pass three levels of inspection in order to be accepted. These three levels are *Quality Control Inspection*, *Quality Assurance Inspection*, and *Final Inspection*. The fabricator shall provide both *Quality Control Inspection* and *Quality Assurance Inspection*. The Contractor shall provide access to the Engineer for the *Final Inspection*.

- A. *Quality Control Inspection* shall be provided by the fabricator on a full time basis during the fabrication process of all major components to assure that the materials and workmanship meet or exceed the minimum requirements of the Contract. *Quality Control Inspection* shall be performed by an entity having a line of responsibility distinctly different from that of the fabricator's fabrication department.
- B. *Quality Assurance Inspection* shall be performed by an agency appointed by the Engineer.
- C. *Final Inspection* of each expansion joint system shall be performed by the Engineer at the job site immediately prior to installation. The Contractor shall provide an accessible work area for this inspection. During *Final Inspection*, the Engineer shall inspect each expansion joint system for

proper alignment, complete bond between expansion joint elastomeric seals and steel components, and proper steel stud placement. There shall be no bends or kinks in the steel components, except as required to follow roadway grades and as specifically detailed on the approved Shop Drawings. Straightening of unintended ends or kinks shall not be permitted. Any expansion joint system exhibiting bends or kinks, other than those shown on the approved Shop Drawings shall be removed from the job site and replaced with a new expansion joint system at the expense of the Contractor. Expansion joint elastomeric seals not fully bonded to the steel shall be made fully bonded at the expense of the Contractor.

627.6.9.3-Acceptance:

- A. Each expansion joint system shall pass all three levels of inspection delineated in Section 627.6.9.2 of this Special Provision prior to acceptance. Any expansion joint system which fails any one of the three levels of inspection shall be replaced or repaired at no expense to the Department and to the satisfaction of the Engineer. Any proposed remedial procedures shall be submitted to the Engineer for approval before implementation.
- B. As stipulated in Section 627.4.16.2.S of this Special Provision, fatigue resistance of all structural members, splices, connections, and components shall be established. For the specific expansion joint system to be installed, the Contractor shall be responsible for assuring that the fabricator has met the prequalification requirements of Section 627.3.8 of this Special Provision, and has performed any requisite fatigue testing in accordance with Sections 627.4.16.3.1, 627.4.16.3.2, and 627.4.16.3.3 of this Special Provision.
- C. Once a fabricator's specific expansion joint system has been prequalified in accordance with Section 627.3.8 of this Special Provision, any revised details or material substitutions shall be retested in accordance with Sections 627.4.16.3.1, 627.4.16.3.2, and 627.4.16.3.3 of this Special Provision. All retesting shall have been completed by the contract award date in accordance with the prequalification requirements of Section 627.3.8 of this Special Provision. Any additional costs and/or time delays incurred as a result of failure to prequalify the details of the revised expansion joint system or delays associated with procuring an alternative expansion joint system fabricator shall be the Contractor's responsibility.

627.8.1 - BASIS OF PAYMENT:

The contract unit price for Modular Expansion Joint System shall be full payment for all materials, including elastomeric concrete, labor, tools, equipment, design, testing, inspection, services, and incidentals necessary to furnish and install the expansion joint systems as specified.

The contract unit price includes the welded wire fabric and concrete placed in the blockouts.

627.9-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
627011-002	REMOVE AND REPLACE EXPANSION DEVICE, MODULAR JOINT	LINEAR FOOT
627020-001	INSTALL MODULAR EXPANSION JOINT SYSTEM	LINEAR FOOT
62702S-002	EXPANSION JOINT SYSTEM BEHIND APPROACH SLAB, MODULAR JOINT	LINEAR FOOT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 203

DISMANTLING STRUCTURES

203.1-DESCRIPTION:

DELETE THE CONTENTS AND REPLACE WITH THE FOLLOWING:

This work shall consist of dismantling such structure or structures specifically designated on the Plans for removal, match marking, handling and storage if called for, or disposal if required.

The Contractor is responsible for determining the current condition of the structure (s) and shall use methods and procedures for dismantling the structures in a safe and efficient manner.

Bridge inspection reports are available for informational purposes and may be viewed at the following location:

West Virginia Division of Highways
1900 Kanawha Boulevard East
Building 5, Room A-350,
~~Maintenance Division~~ Operations Division
Charleston, West Virginia 25305

The work shall also include the preparation of a demolition/dismantling plan by the contractor. The plan shall be prepared and sealed by a Professional Engineer registered in the State of West Virginia, experienced in structural analysis of bridges.

The plan shall include a complete structural analysis for all phases of the demolition/dismantling with due regard to the existing condition of the structure at the time the work is performed. Additionally, the analysis shall show that the structure meets the design criteria of the latest edition, including all Interims, of the *AASHTO Standard Specifications for Highway Bridges*, or the *AASHTO LRFD Bridge Design Specifications* during all phases of demolition/dismantling. The design loads shall match those applied to the structure by the contractor's "means and methods" of demolition/dismantling.

The demolition/dismantling plan shall be provided to the Division's Project Supervisor at least seven calendar days prior to the beginning of any demolition/dismantling work. Receipt of the demolition/dismantling plan does not constitute review or approval or relieve the Contractor of his/her responsibility to satisfactorily demolish/dismantle the structure specified.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 506

CONCRETE PAVEMENT REPAIR

506.4-TESTING:

DELETE THE FIRST PARAGRAPH IN THE SUB-SECTION AND REPLACE WITH THE FOLLOWING:

All testing shall be in accordance with section 501. The Contractor shall fabricate a minimum of nine compressive strength cylinders for each 24-hour period of operation. Six of these nine field cured cylinders shall be field cured in a temperature and moisture condition as close as possible to that of the concrete in the repair area. When the concrete in the repair area must attain the compressive strength, required to open it to traffic in less than 8 hours, the cylinders which represent that concrete shall be cured in a curing device which automatically maintains the curing temperature and duplicates the temperature of the in-place concrete that the cylinders represent. When the average strength of three of these cylinders, representing the concrete placed, indicate that the concrete has attained the required strength for opening to traffic, that concrete may be put into service. These cylinders shall represent concrete produced from the batch from which they were fabricated and, if applicable, concrete from previous batches also. These cylinders will not represent any concrete which was placed after the time that they were fabricated. Three of the nine cylinders shall receive standard curing and shall be tested at 28 days to verify that the required strength at that age has been achieved.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 601
STRUCTURAL CONCRETE**

601.4-TESTING:

601.4.2– Contractor's Quality Control:

DELETE THE LAST PARAGRAPH IN THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

Any Agency or Laboratory which tests Contractor Quality Control concrete compressive strength specimens, that may be used for acceptance by the Division, shall be evaluated by the Cement and Concrete Reference Laboratory (CCRL) and certified by the Division as meeting the all the requirements of ASTM C1077 pertaining to testing concrete cylinders, as outlined in Section 4.2 of MP 601.03.50.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 601
STRUCTURAL CONCRETE**

601.7–MIXING:

DELETE THE FIFTH PARAGRAPH IN THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

The addition of water after completion of initial mixing will not be permitted, except that when concrete is delivered in truck mixers, additional water may be added to adjust to a specified consistency. In this event, a minimum of 20 additional revolutions of the truck mixer drum at mixing speed shall be required before discharge of any concrete; the maximum allowable time between the addition of the cement to the aggregates and the discharge of the batch shall not be exceeded. Concrete that is not within the specified consistency limits at the time of placement shall not be used. When superplasticizer is used to adjust the consistency of a mix at the job site, as outlined in Section 601.3.2.1, water may still be used to adjust the consistency of the mix prior to the job site addition of superplasticizer, but no additional consistency adjustment of that mix with water shall be permitted after the job site addition of superplasticizer. The additional consistency testing required in Section 601.3.2.1 applies each time that superplasticizer is added at the job site. When superplasticizer is used to adjust the consistency of a mix at the batch plant, but not at the job site, as outlined in Section 601.3.2.1, additional consistency adjustment of that mix with water at the job site shall still be permitted.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 601
STRUCTURAL CONCRETE**

601.12-CURING AND PROTECTING CONCRETE:

601.12.1–Curing Under Normal Conditions:

DELETE THE SECOND PARAGRAPH IN THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

Concrete surfaces shall be kept completely and continuously moist. Curing shall be continued for a period of at least 7 days. This curing period may be reduced if the contractor presents evidence that the in-place concrete has attained 70% of the specified strength for the class of concrete under cure. Under no circumstances, shall the period of cure be less than 3 days. The reduced curing period option is not applicable to Class H or Class K concrete. When placing concrete elements with a minimum dimension greater than 2-feet (0.61 m), the contractor shall not be permitted to add additional cement to the target cement factor in the approved mix design in order to obtain high-early strength and/or reduce curing time. Surfaces may have coverings temporally removed for finishing, but the covering shall be restored as soon as possible.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 601
STRUCTURAL CONCRETE**

601.3-PROPORTIONING:

DELETE THE FOURTH PARAGRAPH OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

Design mixture testing for Class H concrete shall be in accordance with MP 711.03.23 and shall include air content, slump, compressive strength, ~~and~~ rapid chloride permeability tests, and surface resistivity testing. For establishment of mixture proportions, rapid chloride permeability tests shall be made on representative samples prepared and tested in accordance with AASHTO T277. The rapid chloride permeability test specimens shall be tested at an age of 90 days (or at any time prior to 90 days), and the results of this test shall not exceed 750 coulombs. Specimens shall be moist cured for 56 days prior to the start of specimen preparation unless specimens are to be tested prior to 56 days, in which case the specimens shall be moist cured until the time of test. The 28-day compressive strength of the test mix that satisfies the 750 coulomb threshold shall be used as the basis for acceptance of Class H concrete per Section 601.4.5. For establishment of mixture proportions, surface resistivity testing shall be performed in accordance with AASHTO T 358. A set of three cylinders shall be fabricated and moist cured, as specified in AASHTO R 39, for 28 days prior to testing. The cylinders may be either 4-inch x 8-inch (100 mm x 200 mm) or 6-inch x 12-inch (150 mm x 300 mm). Surface resistivity test results shall be for information purposes only, but ideally, the average result of the three cylinders should not be less than 61 kΩ-cm for 4-inch x 8-inch (100 mm x 200 mm) cylinders and not less than 53 kΩ-cm for 6-inch x 12-inch (150 mm x 300 mm) cylinders. The cost of all test mix requirements shall be considered incidental to the cost of Class H concrete.

601.4-TESTING:**601.4.1–Sampling and Testing Methods:**

ADD THE FOLLOWING TO THE TABLE IN SUBSECTION 601.4.1:

<u>Surface Resistivity</u>	<u>AASHTO T 358</u>
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601.4.5–Tests for Permeability Acceptance of Class H Concrete:

DELETE THE TITLE OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

601.4.5–Tests for Permeability Acceptance and Surface Resistivity of Class H Concrete:

ADD THE FOLLOWING PARAGRAPH TO THE END OF THE SUBSECTION:

The Contractor shall also be required to fabricate and test three Surface Resistivity test specimens, in accordance with AASHTO T23 and AASHTO T358, every time that a set of compressive strength specimens for Class H concrete is fabricated. These test specimens shall be the same size as the Surface Resistivity test specimens that were tested in the approved mix design, and they shall be tested at an age of 28-days. These test specimens shall be moist cured, in the same manner as the Class H compressive strength specimens, until as close to the time of testing as possible. The average Surface Resistivity test result of these three test specimens shall be used for information purposes only. The 28-day Surface Resistivity result of each of these three specimens, the Project Number for which they were fabricated, and the approved mix design number which was used to batch the concrete shall be forwarded to the following e-mail address: DOHConcreteMixDesign@wv.gov as soon as testing is completed. Average Surface Resistivity results equal to or greater than 29 kΩ-cm for 4-inch x 8-inch cylinders (100 mm x 200 mm) and equal to or greater than 25 kΩ-cm for 6-inch x 12-inch (150 mm x 300 mm) cylinders are considered acceptable.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 601
STRUCTURAL CONCRETE**

601.3-PROPORTIONING:

601.3.1-Mix Design Requirements:

ADD THE FOLLOWING SUBSECTION:

601.3.1.1-Mix Design Using Potentially Reactive Aggregate: Alkali-Silica Reaction (ASR) is a reaction between the alkali hydroxide in concrete pore solution and reactive forms of silica in the aggregate. The reaction forms a gel that swells when moisture is present and may cause deleterious expansion within the concrete.

The Division will sample aggregate according to MP 700.00.01 and test fine aggregate and coarse aggregate in accordance with AASHTO T 303 to determine the reactivity class of aggregate. The reactivity class for each aggregate source will be listed on the MCS&T web page under Division Approved Source/Product Listing (APL) for aggregate. If the reactivity class of an aggregate Source is not listed on the APL, the Division will test fine and coarse aggregate from the Source, in accordance with AASHTO T 303, to determine the reactivity class of the aggregate prior to its use on any WVDOH project. If one or both of the aggregates (coarse or fine) used in a concrete mix are reactive (R1, R2 or R3), preventive measures are required as specified in section 601.3.1.1.1.4.

This requirement applies to all permanent concrete structures on WVDOH projects.

601.3.1.1.1-Selecting Preventive Measures For ASR: The level of prevention shall be determined by considering the classes of concrete, precast concrete member, prestressed concrete member, the degree of aggregate reactivity and the level of alkalis from the Portland cement. The different levels of prevention are shown in Table 601.3.1.1.1.3.

601.3.1.1.1.1-Aggregate Reactivity: The degree of ASR reactivity of an aggregate will be determined as outlined in 601.3.1.1. Aggregate-reactivity classes are given in Table 601.3.1.1.1.1. If the coarse and fine aggregates in a mix design are of different reactivity classes, the level of prevention shall be selected for the most reactive aggregate type in the mix.

TABLE 601.3.1.1.1.1
Classification of Aggregate Reactivity

Aggregate-Reactivity Class	Description of Aggregate Reactivity	14-Day Expansion when tested in accordance with AASHTO T 303, %
R0	Non-Reactive	≤ 0.10
R1	Moderately Reactive	> 0.10 to ≤ 0.30
R2	Highly Reactive	> 0.30 to ≤ 0.45
R3	Very Highly Reactive	> 0.45

601.3.1.1.1.2-Level of ASR Risk: Determine the level of ASR risk occurring in a structure by considering the aggregate reactivity class in Table 601.3.1.1.1.2.

TABLE 601.3.1.1.1.2

Aggregate-Reactivity Class	R0	R1	R2	R3
Level of ASR Risk	Risk Level 0	Risk Level 1	Risk Level 2	Risk Level 3

601.3.1.1.1.3-Level of Prevention: The level of prevention required is determined from Table 601.3.1.1.1.3 by considering the risk of ASR from Table 601.3.1.1.1.2 in different classes of concrete, precast concrete member and prestressed concrete member (Section 603).

TABLE 601.3.1.1.1.3
Determining the Level of Prevention

Level of ASR Risk	Classes of Concrete		Precast Concrete Member	Prestressed Concrete Member
	D	A, B, C, K, H, DC		
Risk Level 0	V	V		V
Risk Level 1	X	Y		Z
Risk Level 2	Y	Z		See footnote**
Risk Level 3	Z	See footnote*		See footnote**

* It is not permitted to construct a structure with classes of concrete (A, B, C, K, H, DC) and precast concrete members when the risk of ASR is Level 3. Measures must be taken to reduce the level of risk in these circumstances by selecting the aggregates only from the Reactivity Classes of R0, R1 or R2.

** It is not permitted to construct prestressed concrete members (Section 603) with Aggregate Reactivity Class of R2 and R3. Measures must be taken to reduce the level of risk in these circumstances by selecting the aggregates only from the Reactivity Classes of R0 or R1.

601.3.1.1.1.4-Requirements for Various Prevention Levels: These requirements shall apply to all classes of concrete except Class H. The prevention levels for Class H concrete is specified in section 601.3.1.1.1.5.

601.3.1.1.1.4.1-Prevention Level V: No special measures need to be taken for prevention level V.

601.3.1.1.1.4.2-Preventions Level X and Y: If it is determined that prevention level X, or Y is required, there are two options for prevention as follows:

Option 1: Limiting the Alkali Content of the Concrete: Table 601.3.1.1.1.4.2a prescribes maximum permissible concrete alkali contents in a concrete mix. The alkali content of concrete is calculated on the basis of the alkali contributed by the Portland cement alone.

TABLE 601.3.1.1.1.4.2a
Maximum Alkali Contents in Portland Cement Concrete
to Provide Various Levels of Prevention

Prevention Level	Maximum Alkali Content of Concrete (Na ₂ O _e)	
	kg/m ³	lb/yd ³
V	No limit	No limit
X	2.4	4.0
Y	1.8	3.0

Note: The alkali content of the concrete is calculated by multiplying the Portland cement content of the concrete by the alkali content of the Portland cement. The alkali content of all approved cement sources is listed on the WVDOH list of Certified Portland Cement Mills. For example, for concrete containing 550 lb/yd³ of Portland cement, which has an alkali content of 0.82 percent Na₂O_e, the alkali content of the concrete is $550 \times 0.82/100 = 4.51$ lb/yd³ Na₂O_e. SCMs also contain alkalis; however, the use of SCM usually increases the amount of alkalis bound by the hydrates and thus reduces the available alkali content in the concrete. Thus, the alkalis present in SCMs do not need to be considered when calculating the alkali content of the concrete. However, the alkali content of the SCM shall not exceed the limits given in Table 601.3.1.1.1.4.2b. The alkali content of all approved SCM source is listed on the WVDOH approved list of SCMs.

Option 2: Using Minimum Supplementary Cementitious Materials (SCM) based on Level of Prevention. Utilize a minimum mass replacement level from Table 601.3.1.1.1.4.2b below.

TABLE 601.3.1.1.1.4.2b

Minimum Replacement Level of SCM (percentage by mass of cementitious material)

Type of SCM	Alkali Content of SCM* (Na ₂ Oe)	Level W	Level X	Level Y
Fly ash** (Cao ≤18%)	≤3.0	15	20	25****
	>3.0, ≤4.5	20	25****	Not Allowed
Slag Cement	≤1.0	25	35	50
Silica Fume***	≤1.0	1.2 x LBA or 2.0 x KGA	1.5 x LBA or 2.5 x KGA	1.8 x LBA or 3.0 x KGA

* The alkali content of all approved SCM sources is listed on the WVDOH approved list of SCMs (APL). If the alkali content of an SCM source is not listed on the APL, the Division will test the SCM from the source to determine the alkali content prior to its use on any WVDOH project.

** The CaO content of approved fly ash sources is listed on the WVDOH approved list of fly ash (APL). If the CaO content of a fly ash source is not listed on the APL, the Division will test the fly ash from the source to determine the CaO content prior to its use on any WVDOH project.

*** The minimum level of silica fume (as a percentage by mass of cementitious material) is calculated on the basis of the alkali (Na₂Oe) content of the concrete contributed by the Portland cement and expressed in lb/yd³ (LBA in Table 601.3.1.1.1.4.2b). LBA is calculated by multiplying the cement content of the concrete in lb/yd³ by the alkali content of cement divided by 100. For example, for a concrete containing 500 lb/yd³ of cement with an equivalent alkali content of 0.81 percent of Na₂Oe, the value of LBA = 500 x 0.81/100 = 4.05 lb/yd³. For this concrete, the minimum replacement level of silica fume for Level Y is 1.8 x 4.05 = 7.3 percent. Regardless of the calculated value, the minimum level of silica fume shall not be less than 7 percent when it is only method of prevention. Mix design with silica fume > 8% shall be reviewed and approved by Engineer.

**** Mix designs with minimum 25% of fly ash shall be reviewed and approved by Engineer.

Note: The minimum replacement levels in Table 601.3.1.1.1.4.2b are appropriate for use with Portland cements of moderate to high alkali contents (0.71 to 1.00 percent Na₂Oe). Table 601.3.1.1.1.4.2c provides recommendations for adjusting the level of SCM when the equivalent alkali content of the Portland cement is above or below this range. The replacement levels should not be below those given in Table 601.3.1.1.1.4.2b for prevention level W, regardless of the equivalent alkali content of the Portland cement.

TABLE 601.3.1.1.1.4.2c

Adjusting the Minimum Level of SCM Based on the Alkali Content of the Portland Cement

Alkali Content (Na ₂ Oe)*	Level of SCM
≤0.70	Reduce the minimum amount of SCM required in Table 601.3.1.1.1.4.2b by one prevention level.*
>0.70, ≤1.00	Use the minimum levels of SCM required in Table 601.3.1.1.1.4.2b
>1.00, ≤1.25	Increase the minimum amount of SCM required in 601.3.1.1.1.4.2b by one prevention level.
>1.25	Not permitted to be used in PCC

* The alkali content of all approved cement sources is listed on the WVDOH list of Certified Portland Cement Mills (APL). If the alkali content of a cement source is not listed on the APL, the Division will test the cement from the source to evaluate alkali content prior to its use on any WVDOH project.

** The SCM replacement levels should not be below those required in Table 601.3.1.1.1.4.2b for prevention level W, regardless of the equivalent alkali content of the Portland cement.

601.3.1.1.1.4.3-Prevention Level Z: If it is determined that prevention level Z is required, limit the maximum alkali content of concrete to $\leq 3.0 \text{ lb/yd}^3$ (1.8 kg/m^3) plus use the minimum SCM replacement level shown for level Y in Table 601.3.1.1.1.4.2b.

The mix design for Prevention Level Z shall be reviewed and approved by the Engineer.

601.3.1.1.1.5-Requirements for Various Prevention Levels for Class H Concrete:

601.3.1.1.1.5.1-Prevention Level V: No special measures need to be taken for prevention level V.

601.3.1.1.1.5.2-Prevention Level Y: The contractor may choose Option 1 from Table 601.3.1C if the alkali content of cement does not exceed 1.00% and the alkali level of fly ash does not exceed 3.00%. The contractor may also choose Option 1 from Table 601.3.1C if the alkali content of cement does not exceed 0.70% and the alkali level of fly ash does not exceed 4.5%. The CaO of the fly ash must be limited to a maximum of 18%.

The contractor may choose Option 2 from Table 601.3.1C if the alkali content of cement does not exceed 0.70%. The alkali level of slag cement shall not exceed 1.00%.

601.3.1.1.1.5.3-Prevention Level Z: The contractor may choose Option 1 from Table 601.3.1C if the alkali content of the concrete does not exceed 3.0 lb/yd^3 (1.8 kg/m^3). See the note in Table 601.3.1.1.1.4.2a for calculating the alkali content of the concrete. The alkali content of the fly ash shall not exceed 3.00%. The CaO of the fly ash must be limited to a maximum of 18%.

The contractor may not choose Option 2 from Table 601.3.1C for Prevention Level Z.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 501

PORTLAND CEMENT CONCRETE PAVEMENT

501.3-PROPORTIONING:

ADD THE FOLLOWING PARAGRAPH AFTER PARAGRAPH ONE:

All design mixes with aggregates that have reactivity classes R1, R2, and R3, as shown as in Approved Aggregates Source List, shall be developed in accordance with subsection 601.3.1.1.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 603

PRESTRESSED CONCRETE MEMBERS

603.6-CONCRETE

603.6.2-Mix Design:

ADD THE FOLLOWING PARAGRAPH AFTER PARAGRAPH TWO:

All design mixes with aggregates that have reactivity classes R1, R2, and R3, as shown as in Approved Aggregates Source List, shall be developed in accordance with subsection 601.3.1.1. If an aggregate Source is not listed on the Approved Aggregates Source List, the Division will test the fine and coarse aggregate from the Source, in accordance with AASHTO T 303, to determine the reactivity class of the aggregate prior to its use on any WVDOH project. The Division will inform the Fabricator of the reactivity class of aggregates that they are proposing to use. If a cement Source and/or a SCM Source are not listed on the Approved Source List, the Division will test cement and/or SCM from that Source prior to its use on any WVDOH project.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 604
PIPE CULVERTS**604.12-INSPECTION AND ACCEPTANCE:**

In addition to the inspection performed by the ~~Department~~ Division during the initial installation of pipe culverts, a post installation inspection will be conducted before final acceptance. No sooner than 30 days following installation, the Engineer will visually inspect all culverts. Pipes larger than 42 inches² in diameter will be manually inspected by inspectors on the project for excessive deflection of flexible pipe, ~~and~~ excessive cracking in rigid pipe, and joint issues for all pipes. Inspectors will note and document any defects with locations in their daily reports.

Any excessive cracks, differential movement, spalls, exposed reinforcement, delamination, slabbing, dents, buckling, holes, damaged coating, obstructions, improperly engaged joints, improper gasket placement, excessive joint gaps, misaligned joints, excessive deflection, or undue horizontal or vertical misalignment will be cause for repair or replacement at no cost to the Division. Efflorescence and rust stains should be evaluated to determine if detrimental or just a cosmetic defect.

604.12.1-Rigid Pipe Criteria: Concrete pipe cracks equal to or less than one hundredth of an inch (0.01) are considered hairline and minor. Cracks greater than one hundredth of an inch (0.01) but less than five hundredths of an inch (0.05), shall be sealed by the method proposed by the manufacturer and approved by the Engineer. Concrete pipe with cracks with width equal to or greater than five hundredths of an inch (0.05) and less than one tenth (0.1) shall be evaluated by the Engineer for repair or replacement. Concrete pipe with cracks one tenth (0.1) inch or greater in width shall be replaced by the Contractor to the satisfaction of the Engineer. Cracking, whether longitudinal or transverse, shall be classified the same.

Spalling is defined as a localized pop-out of concrete along the wall of the pipe/culvert (generally caused by corrosion of the steel reinforcement), or at the edges of longitudinal or circumferential cracks. If spall/chips are detected, there are 3 classifications.

If a spalled area has no exposed reinforcement, then repair the area as a nonstructural repair with a patching material from approved list and meeting Section 715.4 with R-3 requirements and approved by the Engineer. Note these spalls with location in the inspection report.

If a spalled area has exposed reinforcement, with a single spall area less than or equal to 150 square inches, then submit repair plan for approval to the Engineer. Note these spalls in the inspection report.

If a spalled area has exposed reinforcement with a single spall area greater than 150 square inches, then submit a pipe analysis and remediation plan for repair or replacement. Note these spalls in the inspection report.

The person conducting the post installation inspection shall check for possible delamination. If delamination is detected or if a hollow sound is produced when the area is tapped with a device such as a hammer, the manufacturer shall submit a remediation plan for repair or replacement to the Engineer for approval. Note these delaminations in the inspection report.

Slabbing is a structural failure of the pipe that results from radial or diagonal tension forces in the pipe. These failures appear as a separation of the concrete from the reinforcing steel near the crown or invert of the pipe and may span the entire length of the of a pipe section. Remediation methods shall be in accordance with recommendations of the pipe manufacturer, be acceptable to and approved by the Engineer before proceeding, and shall be the sole responsibility of the Contractor. Where slabbing is of such magnitude that-, in the opinion of the Engineer, the integrity or service life of the pipe or culvert is severely compromised in the opinion of the Engineer, the section(s) of pipe shall be replaced at the Contractor's expense to the satisfaction of the Engineer.

If joint separation is greater than the joint gap installation allowance but less than the maximum joint gap allowance noted in Tables A or B and soil tight, then the pipe joint will be accepted with reduced payment for the section of pipe on each side of the joint (including excavation, pipe, and backfill). Note all joint gaps that are greater than the installation allowance in the inspection report.

If joint separation is greater than the maximum joint gap allowance noted in Tables 604.12.1A or 604.12.1B and soil tight, then submit a remediation plan for repair or replacement to the Engineer. Note all joint gaps that are greater than the installation allowance in the inspection report.

If any soil infiltration is identified at the pipe joint during inspection, a pipe analysis and a remediation plan for repair or replacement shall be submitted to the Engineer for approval. Note all joint with soil infiltration in the inspection report.

<u>Table 604.12.1A. Round Pipe</u>		
<u>Pipe Diameters (inch)</u>	<u>Joint Gap Installation Allowance (inch)</u>	<u>Maximum Joint Gap Allowance(inch)</u>
<u>12 to 36</u>	<u>0.700</u>	<u>1.000</u>
<u>42 to 54</u>	<u>0.800</u>	<u>1.200</u>
<u>60 to 72</u>	<u>0.850</u>	<u>1.275</u>
<u>78 to 90</u>	<u>0.900</u>	<u>1.350</u>
<u>96 and above</u>	<u>1.000</u>	<u>1.500</u>

Table 604.12.1B. Elliptical Pipe

<u>Pipe Diameters (inch)</u>	<u>Joint Gap Installation Allowance (inch)</u>	<u>Maximum Joint Gap Allowance (inch)</u>
<u>18 to 36</u>	<u>0.750</u>	<u>1.125</u>
<u>42 to 48</u>	<u>0.850</u>	<u>1.275</u>
<u>54 to 60</u>	<u>0.900</u>	<u>1.350</u>
<u>66 to 72</u>	<u>1.200</u>	<u>1.500</u>

604.12.2-Flexible Pipe Criteria: Flexible pipe deflection equal to or less than 5 percent of the original diameter will not require remediation. Deflections of 5 percent up to 7.4 percent of the original diameter will be evaluated by the Engineer for repair or replacement. If flexible pipe is deflected 7.5 percent of the original diameter, the pipe shall be replaced by the Contractor to the satisfaction of the Engineer. Note all deflections in the inspection report.

Pipe with cracks less than 0.125 inch in width and less than 6 inches in length without water leakage or soil infiltration will be accepted. Pipe with cracks less than 0.125 inch in width with water leakage or soil infiltration will need a repair plan submitted by the contractor and approved by the Engineer. Plastic pipe with cracks exceeding 1/80.125- inch width by 6-inches long shall be evaluated by the Engineer for structural and hydraulic integrity with repair or replacement at no cost to the Division as an option. Note all cracks in the inspection report..

Pipes showing evidence of crushing at the joints will need a repair plan submitted by the contractor and accepted by the Engineer with replacement at no cost to the Division is an option if necessary. Differential movement, improper joint sealing, movement, or settlement of pipe sections will be noted in the inspection report. Joint separation greater than 1 inch will require a repair plan or replacement. Evidence of soil migration through the joint will be further investigated by the Engineer to determine the level of remedial action required by the contractor at no cost to the Division. Note all joint flaws in the inspection report.

604.12.3-Testing of Pipe: A post installation camera/video inspection of pipe culverts and laser/mandrel deflection inspection of flexible pipe shall be conducted by the Contractor on all pipe culverts that meet the following requirements:

1. Cumulative total of 250 linear feet (75 m) or more of pipe culverts on project
2. Project located on NHS routes

The Contractor may visually inspect, in the presence of the Engineer, in lieu of camera/video inspection where pipe culverts size, orientation, and location allow for easy visual examination.

When camera/video inspection is required, it shall be conducted by the Contractor in the presence of the Engineer. The Contractor will note and document any defects or flaws with locations in their reports. Equipment used in these inspections must have the following features:

Camera Inspection Equipment shall be:

1. Configured properly in the pipe both vertically and horizontally, and having the ability to pan and tilt to a 90 degree angle with the axis of the pipe and rotate 360 degrees.
2. Low barrel distortion camera.

3. Color image with a minimum standard resolution of 720x480 pixels.
4. Equipped with sufficient lighting to provide a clear image of the full circumference of the pipe.
5. Capable of recording the station, milepost, distance along the invert of the pipe, or other indicators of location superimposed on the video.
6. Capable of moving through the entire length of the pipe.
7. Software capable of generating a report that shows each fault along with its location from the inspection entrance and a still frame image of the fault.

Laser deflection measure device on flexible pipe up to 48 inches in diameter shall be capable of measuring deflection to an accuracy of 0.5% or better with a repeatability of 0.12% or better.

Mandrel device must have an odd number of legs (9 minimum) having a length not less than the outside diameter of the mandrel. The diameter of the mandrel, whether it is fixed or variable size, must be verified with a proving ring or other method as per the manufacturer's guidelines. The diameter of the mandrel at any point shall not be less than the diameter specified in Table 604.12.3.

Table 604.12.3 Deflection Limits				
<u>Base Pipe Diameter</u>	<u>AASHTO Nominal</u>	<u>Max Deflection Limit</u>		
		<u>5.0%</u>	<u>7.5%</u>	<u>10.0%</u>
<u>(inches)</u>	<u>(inches)</u>	<u>(inches)</u>		
<u>15</u>	<u>14.76</u>	<u>14.02</u>	<u>13.65</u>	<u>13.28</u>
<u>18</u>	<u>17.72</u>	<u>16.83</u>	<u>16.39</u>	<u>15.95</u>
<u>24</u>	<u>23.62</u>	<u>22.44</u>	<u>21.85</u>	<u>21.26</u>
<u>30</u>	<u>29.53</u>	<u>28.05</u>	<u>27.32</u>	<u>26.58</u>
<u>36</u>	<u>35.43</u>	<u>33.66</u>	<u>32.77</u>	<u>31.89</u>
<u>48</u>	<u>47.24</u>	<u>44.88</u>	<u>43.70</u>	<u>42.52</u>
<u>54</u>	<u>53.15</u>	<u>50.49</u>	<u>49.16</u>	<u>47.84</u>
<u>60</u>	<u>59.06</u>	<u>56.11</u>	<u>54.63</u>	<u>53.15</u>

The Contractor shall provide a digital copy of the camera/video inspection and issue a report in digital format, detailing all issues or deficiencies noted during the inspection, including a remediation plan for each deficiency, no later than 7 calendar days after completion of the inspection.

FOR

FEDERAL PROJECT NUMBER: _____

SPRAY APPLIED AND SPIN-CAST PIPE LINING

This work shall consist repairing and rehabilitating culverts and storm drain pipes by filling voids and lining the entire interior surface of the pipe with factory blended cementitious material. Material may be spray applied, centrifugally spin-cast or applied with hand tools. Application methods may vary based on the size and shape of the culvert. The term “host pipe” refers to the existing pipe being rehabilitated. This is applicable for pipes ranging in size from 30” to 120”.

Furnish materials for patching and filling voids conforming to the following.

Cementitious Materials	ASTM C1157
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Furnished cementitious liner material that meets the following minimum property requirements:

Page 1 of 4

		28 Days	Minimum	670 psi
ASTM C 1090	Height Change	28 Days	Maximum	-0.08%
ASTM C 1583	Bond Strength	28 Days	Minimum	615 psi
ASTM C 403	Set Time	Initial Set	Maximum	170 minutes
		Final Set	Maximum	300 minutes
ASTM C 666	Freeze Thaw	300 Cycles	40-0 °F and 0-40 °F in not less than 2 nor more than 5 hrs	
ASTM C 1202	Chloride Permeability	28 Days	Maximum	< 550 Coulombs

613.3-SHIPMENT AND STORAGE:

Materials supplier and Contractor shall follow the manufacturer's recommendations for shipment and storage for all products, and ensure that the material safety data sheet accompanies the material.

The Contractor shall not use material from defective, punctured, or damaged containers and ensure that each container is labeled with a batch or lot number and an expiration or use by date. Contractor shall not use material that exceeds the use by date or useful life.

613.4-INSTALLATION PLAN:

The Contractor shall submit a written installation plan for the pipe renewal to the Engineer for acceptance at least ten days before beginning work. The submission shall include the following information:

1. All calculations shall be performed and signed and sealed by a registered Professional Engineer in the state of West Virginia. The designer shall ensure that the design of the structural spray liner rehabilitation system will support the dead load and live load. Ensure the calculations address the spray liner physical properties and the lining thickness. The minimum allowable thickness is 0.5 inch. The calculated minimum finished thickness of the liner shall be based on a maximum possible crack width of 0.01 inch with a factor of safety of 2.0. Liner thicknesses do not have to be uniform.
2. Invert thickness and material.
3. Method of cleaning the host pipe.
4. Plan to bypass flow around the host pipe.
5. Method to verify applied thickness during installation.
6. Video survey of the host pipe before installation.
7. Site specific health and safety plan.
8. A certification letter from the manufacturer stating that the contractor is an approved installer of the material.

Allow ten days for review. Do not begin work until the submittal has been accepted by the Engineer. Any changes or deviations from the accepted submittals must be resubmitted. The Engineer will not grant an extension of time because of incomplete submittals.

During construction, the contractor shall submit the following information to the Engineer:

1. Test results performed that demonstrate the liner material meets the material requirements.

2. Daily thickness measurements of the spray material.
3. Temperature and humidity readings in the host pipe.

613.5-CONSTRUCTION:

- A. **Preparation.** Remove all debris and obstructions from the host pipe. Clean and prepare the surface of the host pipe according to the manufacturer's recommendations.
- B. **Flow Bypass.** Prevent the accumulation and flow of water through the host pipe and liner until after the work is complete. When required, bypass flows around the host pipe in accordance with the requirements of the special provisions of the contract. After the lining process begins, maintain the bypass flow until the lining process, including curing, is complete. All immediately connected manholes and inlets should be plugged to prevent water from coming through the host pipe. Comply with USACE 404 and NPDES permits if applicable.
- C. **Preinstallation inspection.** After cleaning and before beginning the lining process, inspect the host pipe to ensure there are no obstructions that would hinder the lining process. Perform a pre-installation video survey of the host pipe and provide a copy of the video to the Engineer.
- D. **Installation.** Measure and record the temperature and humidity. The upper limit ambient and surface temperature is 100 Degrees Fahrenheit. The lower limit is 45 Degrees Fahrenheit when ambient temperatures are expected to fall below within 72 hours of placement. Suspend work if conditions are expected to be outside the acceptable range.

Patch holes and gaps in the host pipe with an approved hydraulic cement or the same cementitious or geopolymer based material to be used for the liner to provide a solid continuous surface on which to spray. Completely stop water infiltration into the host pipe.

Protect walls, surfaces, streambeds and plants at the entrance and exit of the host pipe from overspray. Apply the material to the prepared surface using methods that provide a uniform surface. Use only equipment recommended by the manufacturer to perform the spray lining. Minimize hand troweling to the extents practicable.

Record the batch or lot number from the containers and weight of material used each day.

For cementitious material, prepare 3 specimens for the 1 day and 3 specimens for the 7 day and 3 specimens for the 28-day test as required per ASTM C109. Prepare an additional 3 specimens for reserve for a total of 12 test specimens. Utilize an ACI Certified level one sample technician or WVDOH equivalent to properly obtain and transport the test specimens to an accredited third-party laboratory. Conduct air testing daily to ensure cementitious material is within manufacturers specifications.

Ensure the liner is continuous over the entire length of the host pipe and free from defects such as foreign inclusions, holes, and cracks larger than 0.01 inches wide. Ensure the renewed pipe is impervious to infiltration and exfiltration.

613.6-AFTER INSTALLATION:

The Contractor shall repair all defects in the liner as directed by the Engineer. All repairs shall be at no additional expense to the Division.

Perform non-destructive testing to verify liner thickness at the crown, invert, and spring lines at an interval of 20 ft for the entire length of the liner. Ensure the accuracy of the pachometer by physically measuring the liner thickness at the ends of the pipe or by other methods accepted by Engineer. Other non-destructive testing methods may be used if accepted by the Engineer. Furnish all the measurements to the Engineer.

613.7-WARRANTY:

Manufacturer shall warrant all work against defects in materials and Licensed Applicator shall warrant all work against defects in workmanship for a period of one (1) year, unless otherwise noted, from the date of acceptance of the lining work. Manufacturer / Licensed Applicator shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship, as applicable, which may develop during said one (1) year period, at Licensed Applicators expense and without cost to the Division.

613.8-METHOD OF MEASUREMENT:

Invert and void repair will be paid based on the quantity of mortar used. This is due to the difficulty in measuring the in-place quantity and will require a careful accounting of the material used. Spray applied pipe lining will be paid based on the surface area of pipe covered at the specified thickness.

613.9-BASIS OF PAYMENT:

Payment for Pipe renewal includes excavation, backfill, encasement, preparation, flow bypass, inspections, and all other work required to complete the specified items.

613.10-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
613001-*	Invert & Void Repair	Pound
613002-*	Spray Applied Pipe Lining, "thickness"	Square Yard
613003-*	Spin-cast Pipe Lining, "thickness"	Square Yard

* Sequence Number

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 663
PAVEMENT MARKINGS**

663.2–MATERIALS:

ADD THE FOLLOWING TO THE END OF THE SUBSECTION:

All Type S markers shall be as detailed on WVDOH Standard Details Volume II sheet TEM-4. The reflector holders, as shown on sheet TEM-4, utilized for Type S markers shall have the following characteristics:

1. Manufactured using a non-metallic material, such as polycarbonate, which has excellent dimensional stability and high impact strength over a wide temperature range.
2. Conformance to the dimensions provided by the slot cut. The width of the holder shall be 4-3/4 inches (121 mm) maximum in order for a gap to remain on either side of the holder and the vertical wall of the slot cut to allow for water flow. The depth and length of the holder shall be such that no portion of the bottom of the holder will come into contact with the bottom of slot cut.
3. Shall include ridges or “teeth” along the leading edges designed to be below the surface of the epoxy and to “lock” the holder into the epoxy.
4. Shall include positioning tabs designed to rest on the pavement surface and insure that the top of the reflectors installed in the holder are consistently placed 0.12 +/- 0.03 inches (3.0 +/- 0.8 mm) below the pavement surface. These tabs shall be designed to break away from the holder when impacted by a plow blade.
5. Shall be designed to incorporate reflectors listed on the WVDOH “Type P-2 Raised Pavement Markers” Approved Products List (APL) and noted as being compatible with Model 101 castings.

6. Shall have demonstrated an acceptable level of performance on one or more WVDOH demonstration or test installations prior to advertisement of this Contract.

A model reflector holder known to meet the above requirements is R-100 reflector holders manufactured by Marker One of Schaumburg, IL.

663.3-TYPES OF PAVEMENT MARKINGS:

663.3.10-Raised Pavement Markers (RPM):

DELETE THE CONTENTS OF THE SUBSECTION AND REPACE WITH THE FOLLOWING:

RPM's include reflective Type P-2, Type S, and Type R-4 markers. Typical placement details for Type P-2 markers are included on revised Standard Detail TEM-4. Type S markers shall be installed on this project in lieu of Type P-2 markers where Type P-2 markers would otherwise be required to be installed with the exception of markers installed along the contour of gore areas. Any Type S markers installed along channelizing lines shall be placed at a spacing of forty (40) feet in lieu of the twenty (20) foot spacing shown on sheet TEM-4.

663.5-APPLICATION:

663.5.9-Raised Pavement Markers (RPM's):

DELETE THE CONTENTS OF THE SUBSECTION AND REPACE WITH THE FOLLOWING:

Unless otherwise directed by the project Engineer or specified herein, RPM's shall be placed as specified in the project plans. If the placement is not specified in the project plans, the placement shall be in accordance with the typical placement drawings included in the Standard Details. The proposed placement of all RPM's shall be reviewed and approved by the project Engineer prior to proceeding.

In all cases, the reflective faces of RPM's shall be perpendicular to a line parallel to the roadway centerline.

The Contractor shall be responsible for the replacement of any markers having failed due to non-conformance with any portion of the specifications herein, and shall incur all associated costs. The Contractor shall also be responsible for the repair of any pavement surfaces damaged and requiring repair, as determined to be necessary by the project Engineer and by a method approved by the project Engineer, due to non-conformance with any portion of the specifications herein, and shall incur all associated costs.

663.5.9.1-Type P-2 Marker and Type S Marker Installation: Up until the time of installation, Type P-2 and/or Type S markers should be stored indoors and should be protected from any source of moisture both during shipment to the jobsite and at the jobsite. The markers should be maintained at a high enough temperature as to preclude moisture

condensation. At the time of placement, both the markers and their storage containers shall be dry.

At the time of installation, the exposed surfaces of Type P-2 castings and/or Type S marker reflector holders shall be free of scale, dirt, rust, oil, grease, or any other contaminant which may impair adhesion. If upon inspection the project Engineer determines that one or more of the markers are not sufficiently in conformance with this requirement, the Contractor shall clean each contaminated holder and/or reflector holder by sand blasting or other means acceptable to the Engineer in order to remove all such foreign matter prior to installation.

The location of placement for each Type P-2 and/or Type S marker shall be of a constant slope longitudinally and laterally, and homogeneous. The location shall show no visible signs of distress or failure, such as cracking or delamination. All edges of the marker shall be placed a minimum of two (2) inches (50 mm) from any portion of the road surface showing such signs of distress or failure. Type P-2 and/or Type S markers shall be placed such that all edges are a minimum of (2) inches (50 mm) from any lateral construction joint. In addition, Type P-2 RPM's shall not be placed within an intersection with a public street or highway where the placement of the marker creates a likelihood that the marker will be plowed in a direction other than that which the marker is designed for. In addition, if it is determined during pre-installation planning that a marker would be placed at a point with one of the aforementioned pavement surface defects, or at a lateral construction joint, or within the intersection of a public street or highway as a result of typical marker spacing, the affected marker may be relocated longitudinally a sufficient distance to be approved by the project Engineer. The distance the marker may be relocated shall not exceed ten (10) % of the typical marker spacing. Where it would be necessary to relocate the marker a distance greater than ten (10) % of the typical marker spacing, the affected marker shall be deleted. The reflective face of the marker shall be perpendicular to a line parallel to the roadway centerline.

Type P-2 markers and/or Type S markers to be installed to supplement a broken line, such as a lane line, shall be placed in line with the pavement marking and within the gaps along the line at the appropriate spacing. Type P-2 and/or Type S markers supplementing a solid line, such as a channelizing line, shall be installed immediately adjacent to the line with the edge of the P-2 casting and/or the edge of the Type S marker slot cut against the edge of the line. With the exception of markers installed to supplement yellow centerline markings, all Type P-2 and/or Type S markers shall be installed such that the near edge of the marker casting is a minimum of two (2) inches (50 mm) from the nearest longitudinal construction joint. Individual markers may be shifted laterally up to two (2) inches (50 mm), and up to ten (10) % of the typical marker spacing longitudinally in order to meet this requirement. Where it would be necessary to shift the marker a greater distance laterally and/or longitudinally as allowed above, the affected marker shall be deleted.

The recesses for P-2 markers shall be machine cut fully in accordance with the marker manufacturer's specifications pertaining to, but not limited to, dimensions and blade configuration. The slot cut recesses for Type S markers shall be machine cut fully in accordance to WVDOH Standard Details Volume II Sheet TEM-4. All P-2 and/or Type S markers shall be installed within seven (7) days of cutting the recesses. All recesses shall be dry at the time of installation of the markers, and the pavement and ambient air temperature shall be a minimum of fifty (50) degrees Fahrenheit (10 degrees Celsius) and

rising. Prior to installation of the markers, the recesses shall be brushed or blown clean of any loose material.

Epoxy adhesive recommended by the marker manufacturer and meeting the requirements of Materials Section 715.40.6 shall be used to adhere the Type P-2 marker castings and/or Type S marker reflector holders in the recesses. Unless otherwise specified by the adhesive manufacturer, the epoxy adhesive shall be mixed by combining components A and B in a ratio of 1:1 by volume. The epoxy adhesive requires that the mixing operation and placing of the pavement markers be done rapidly. Any mixed batch that becomes so viscous that it cannot be readily extruded from under the casting or holder under light pressure shall not be used. Unless otherwise specified or allowed by the adhesive manufacturer, the adhesive shall be maintained at 60 to 80 degrees Fahrenheit (15 to 27 degrees Celsius) before mixing, and shall not be heated above 120 degrees Fahrenheit (49 degrees Celsius) once mixing starts. Any heating of the epoxy shall be by the application of indirect heat. The Contractor shall insure that the epoxy is thoroughly mixed until it is one homogeneous color. The epoxy shall be placed fully in accordance with the epoxy manufacturer's specifications. Any requirements made by the manufacturer of the specific adhesive used which are more stringent than those contained herein shall take precedence.

The Contractor shall install P-2 marker castings and/or Type S marker reflector holders in the recesses using the epoxy adhesive fully in accordance with the marker manufacturer's specifications. Sufficient epoxy shall be placed in the recess to ensure that all voids beneath and around the casting are filled so as to create a watertight seal around the casting. Sufficient epoxy shall be placed in the plunge cut areas of the recesses of the Type S markers to insure all voids beneath the reflector holder are filled and to insure that any contoured edges along the front and the back of the holder designed to "key" the holder into the epoxy are submerged in the epoxy. The casting and/or reflector holder shall be hand placed into the recesses. The Contractor shall insure that each of the lugs on the sides of the casting and/or reflector holder are resting on the pavement. The tips of the casting snowplow deflecting surface(s) shall be below the pavement surface. The Contractor shall take reasonable steps to avoid buildup of epoxy on either the pavement surface or the casting and/or reflector holder lip in front of the lens as this buildup will affect the maximum visibility distance of the markers. There shall be no epoxy on the marker lens. If this occurs, the Contractor shall replace the marker lens in accordance with the specifications herein and will incur all costs associated with this.

Newly installed P-2 and/or Type S markers shall not be exposed to traffic until the epoxy adhesive has sufficiently cured. The amount of cure time required is based on the ambient air temperature. The Contractor shall follow the recommendations of the adhesive manufacturer. In no case shall the newly installed markers be exposed to traffic within a time period less than that which is shown in the following table:

Ambient Air Temperature, °F (°C)	Minimum Protection Time (minutes)
100 (38)	15
90 (32)	20
80 (27)	25
70 (21)	30
60 (16)	35
50 (10)	45

663.5.9.3-Type R-4 Marker Installations: The color(s) of the lenses and bodies of Type R-4 markers shall be in accordance with the Standard Details unless specified otherwise in the project plans.

Up until the time of installation, Type R-4 markers should be stored indoors and should be protected from any source of moisture both during shipment to the jobsite and at the jobsite. The markers should be maintained at a high enough temperature as to preclude moisture condensation and, at the time of placement, both the markers and their containers shall be dry.

Unless otherwise specified in the project plans or in the Standard Details, Type R-4 markers to be installed along a broken line, such as a lane line, shall be placed in line with the pavement marking and within the gaps along the line at the appropriate spacing. Type R-4 markers supplementing a solid line, such as a channelizing line, shall be installed immediately adjacent to the line with the edge of the marker against the edge of the line. If a Type R-4 marker is to be installed in line with a solid line pavement marking, the Contractor shall omit the pavement marking at the locations where the R-4 markers are installed or are to be installed. R-4 markers shall not be placed on top of existing pavement markings.

The location of placement for each Type R-4 marker shall be of a constant slope longitudinally and laterally, and homogeneous. The location shall show no visible signs of distress or failure, such as cracking or delamination. All edges of the marker shall be placed a minimum of two (2) inches (50 mm) from any portion of the road surface showing such signs of distress or failure. Type R-4 markers shall be placed such that all edges are a minimum of (2) inches (50 mm) from any lateral construction joint. If during pre-installation planning, it is determined that a marker would be placed at a point with one of the aforementioned pavement surface defects, or at a lateral construction joint, the affected marker may be relocated longitudinally a sufficient distance to be approved by the project Engineer. The distance the marker may be relocated shall not exceed ten (10) % of the typical marker spacing. Where it would be necessary to relocate the marker a distance greater than ten (10) % of the typical marker spacing, the affected marker shall be deleted. The reflective face of the marker shall be perpendicular to a line parallel to the roadway centerline. Type R-4 markers shall not be installed across a longitudinal pavement joint. Affected markers shall be shifted if necessary such the edge of the marker body is along the edge of the joint.

All applications shall be made on dry pavement surfaces free of extraneous materials such as, but not limited to, dirt, dust, grease, oils, existing pavement markings, and excessive remnants of previous delineation or channelization devices such as adhesive. Extraneous materials shall be removed prior to placement by means approved by the project Engineer, such as sweeping, high pressure air, scraping, or grinding. The project Engineer shall make the final determination as to when the existing surface has been sufficiently cleaned for placement of the markers.

Type R-4 markers shall be applied to the asphalt or concrete surface fully in accordance with the manufacturer's recommendations using an adhesive recommended by the marker manufacturer. The adhesive shall be either 1) a rapid set epoxy adhesive, 2) a standard set epoxy adhesive, or 3) a bitumen adhesive, and shall meet any applicable requirements contained in Materials Section 715.40.6. The Contractor is cautioned in regards to the

application of markers to new asphalt or concrete surfaces. If the markers are to be applied to a new asphalt surface, the Contractor shall consult with the adhesive manufacturer and follow all recommendations of the adhesive manufacturer in regards to special surface preparation steps or recommended waiting periods between the completion of paving operations and adhesive application. In no case shall the markers be placed until the new asphalt surface has cured for a minimum period of fourteen (14) days. If the markers are to be applied to a new concrete surface less than ninety (90) days after concrete placement, any remaining curing compound on the application surface shall be removed by a project Engineer approved method and procedures such as sandblasting, hydro-blasting, shot blasting, or grinding. Regardless of the type of adhesive used, type R-4 markers shall not be placed under the following conditions:

1. When either the pavement or air temperature is 32°F (0°C) or less when using rapid set epoxy, 50°F (10°C) or less when using standard set epoxy, or 40°F (4.4°C) or less when using bitumen adhesive.
2. If the relative humidity of the air is greater than 80 %
3. If the pavement is not surface dry or if there has been rainfall in the previous 24 hours

If the markers are to be applied using an epoxy adhesive, this requires that the mixing operation and placing of the markers be done rapidly. If standard set epoxy adhesive is used, the Contractor may mix this material by hand; however, not more than one (1) qt (1 L) shall be mixed at one time and the markers shall be aligned and pressed into place within five (5) minutes after mixing operations are started. Any mixed batch which becomes so viscous that the adhesive cannot be readily extruded from under the marker on application of slight pressure shall not be used. Rapid set epoxy adhesive shall not be mixed by hand; it shall be mixed by a 2-component type automatic mixing and extrusion apparatus. Automatic mixing equipment for the epoxy adhesive shall use positive displacement pumps and shall properly meter the two components in the specified ratio. At any time requested by the project Engineer, the ratio shall be checked by the Contractor in the presence of the Engineer. This check shall be made by disconnecting the mixing heads, or using suitable bypass valves, and filling two suitable containers with the unmixed components. The mixing head shall properly mix the two components so that there is no trace of black or white streaks in the mixed material. Voids in a cured, undisturbed sample of the mixed adhesive obtained from the extrusion nozzle should not exceed four (4) %.

When machine mixing standard or rapid set epoxy adhesives, the markers shall be placed within sixty (60) seconds after the adhesive has been mixed and extruded, and no further movement of the marker shall be allowed. In addition, no more than ninety (90) seconds shall be permitted between the time the adhesive is in place on the roadway and the marker is no longer subjected to further movement. The mixed adhesive should not remain in the mixing head for more than forty-five (45) seconds. Adhesive remaining in the mixing head longer than this period shall be wasted before resuming the operation.

When applying the markers with epoxy adhesive, the adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the marker in a quantity sufficient to result in complete coverage of the area of contact of the marker with no voids present and with a slight excess after the marker has been lightly pressed in place. Ideally there will be approximately 0.060 in. (1.5 mm) adhesive between the marker and the pavement. Excess adhesive around the edge of the marker, excess adhesive on the

pavement, and adhesive on the exposed surfaces of the markers shall be immediately removed. Soft rags moistened with mineral spirits in accordance with Federal Specification TT-T-291 or kerosene may be used to remove adhesive from exposed faces of pavement markers. No other solvent shall be used. The markers should be protected against impact until the adhesive has hardened to a sufficient degree, as determined by the project Engineer.

Bituminous adhesive shall be dispensed from a thermostatically controlled melter-applicator at a temperature of 375 to 425 degrees Fahrenheit (141 to 218 degrees Celsius). The material shall be stirred frequently to ensure even heating. The adhesive shall be dispensed in a puddle slightly larger than the bottom of the marker, and the marker shall be dropped onto the puddle as quickly as possible, preferably within five (5) seconds of adhesive placement. The marker shall then be pressed lightly onto the adhesive. The adhesive will set up in approximately two (2) minutes and typically no longer requires protection from traffic.

Any requirements made by the manufacturer of the specific adhesive used, which are more stringent than those contained herein, shall take precedence.

663.6-METHOD OF MEASUREMENT:

ADD THE FOLLOWING PARAGRAPH TO THE END OF THE SUBSECTION:

Type P-2 markers, Type S markers, and Type R-4 markers shall be measured in units of each, completely installed as specified herein. Payment for the installation of Type P-2 and Type S markers shall include payment for the marker lens.

663.8-PAY ITEMS:

ADD THE FOLLOWING ITEMS TO THE TABLE:

ITEM	DESCRIPTION	UNIT
663013-004	Slotted Marker, Type S	Each

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 707

CONCRETE ADMIXTURES, CURING AND COATING MATERIALS

707.4-SUPPLEMENTARY CEMENTITIOUS MATERIALS (Scms) FOR USE IN PORTLAND CEMENT CONCRETE:

ADD THE FOLLOWING SENTENCE AT THE BEGINNING OF THE SUBSECTION:

All SCMs shall be approved in accordance with MP 707.04.10.

DELETE SUBSECTION 707.4.1 AND REPLACE WITH THE FOLLOWING:

707.4.1-Fly Ash: Fly ash shall ~~conform to meet~~ the ~~following~~ requirements of ASTM C618, Class F or C when sampled and tested in accordance with the applicable Section of ASTM C311.

Fineness	Class F (ASTM C618)	Class C (ASTM C618)
Amount Retained on No. 325 (45 µm) Sieve	34% Max.	34% Max.
Loss on Ignition:	6% Max.	6% Max.
SiO₂+Al₂O₃+Fe₂O₃	70% Min.	50% Min

Fly ash with an amount retained on the No. 325 (45 µm) sieve >34% but ≤40% shall be considered as meeting specification requirements provided either of the following criteria are met:

- i. 50% minimum reduction in mortar bar expansion when tested in accordance with ASTM C441. The alkali content of test mix shall be equal to or greater than the control mix. The weight of fly ash shall be 20-30 % of weight of cementitious materials.
- ii. 0.1% maximum mortar bar expansion, at 16 days after casting, when tested in accordance with ASTM C1567. Very highly reactive aggregate (R3 Class from AASHTO R 80) shall be used as fine aggregate. The weight of fly ash shall be ≤ 35% of the weight of total cementitious materials.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

**SECTION 715
MISCELLANEOUS MATERIAL**

715.11-ENGINEERING FABRIC:

715.11.2-Acceptance:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

All engineering fabric shall be approved before use. ~~When using a fabric not on the Division's approved list, the Contractor shall furnish certified test data with each shipment of fabric. Compliance of this data with the requirements of the specific application will be the basis of acceptance. NTPEP test data shall be furnished for the engineering fabric to be approved. The test data must be for the current 3-year cycle for the manufacturer or private labeler providing the material. The engineering fabric shall have a manufacture date within the current three-year NTPEP evaluation cycle of the manufacturer's, or private labeler's facility providing the material. The manufacturer or private labeler must be listed as NTPEP compliant for the current calendar year or be listed as compliant for the previous calendar year and have an application for audit during the current year.~~

~~The test results submitted shall be derived from testing samples representing the fabric contained in each shipment. Tests for all required properties shall be performed in accordance with the procedures specified. Each roll shipped shall be identified so as to show its relationship to the test data submitted. The West Virginia Division of Highways may sample and test materials from a project or facility at any time to verify compliance with WVDOH specification requirements. Failure of the product, or failure to supply the required information may result in the product not being accepted or removed from the approved list.~~

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SUPPLEMENTAL SPECIFICATION

FOR

SECTION 720 SMOOTHNESS TESTING

720.5-NATIONAL HIGHWAY SYSTEM (NHS) PAVEMENT PROJECT:

720.5.4-Schedule 3 NHS Pavement Projects:

DELETE THE CONTENTS OF THE SUBSECTION AND REPLACE WITH THE FOLLOWING:

NHS pavement projects with a pavement thickness less than three (3) inches and more than one (1) inch shall be classified as Schedule 3 NHS Pavement Projects. The final price adjustments for Schedule 3 NHS Pavement Projects shall be determined using the calculations shown in Table 720.5.3.

TABLE 720.5.4
Schedule 3 NHS Pavement Projects

IRI for each 0.1-mile section (in/mi)	Price Adjustment (\$)
46.0 <u>27.0</u> or Less	+ 300 <u>720</u>
46.1 <u>27.1</u> to 76.0 <u>50.0</u>	- 10 <u>30</u> (IRI) + 760 <u>1530</u>
76.1 <u>50.1</u> or Greater	0

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 615
STEEL STRUCTURES**

615.1-GENERAL

615.1.1-Description:

ADD THE FOLLOWING SUBSECTION:

615.1.1.1-Miscellaneous Bridge Work: This work consists of performing miscellaneous bridge repairs to the Wheeling Suspension Bridge in accordance with the Standard Specifications, Special Provisions, and the details shown on the plans. The requirements of Section 615 of the Standard Specifications shall apply as amended by the requirements provided for specific repair items.

Field verification of all existing conditions and repair detail dimensions is required before fabrication of any component or ordering of materials. Verification is incidental to repair cost.

Submit Shop Drawings for Approval in Accordance with Section 105.2. Include complete details of the methods, materials and equipment proposed for use on the drawings. Do not start fabrication until approval has been obtained.

Access for Department Staff must be provided for inspection of work and is incidental to the cost of repair.

Requirements for each repair are as follows:

- A. **Repair C2A – Navigation Light Platforms – Configuration 1:** Refer to Contract Plans for repair details. Paint all elements of repair consistent with paint colors of elements they are replacing. All labor and material necessary to complete this repair, including removal of portion of existing platforms, is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- B. **Repair C2B – Navigation Light Platforms – Configuration 2:** Refer to Contract Plans for repair details. Paint all elements of repair consistent with paint colors of elements they are replacing. All labor and material necessary to complete this repair,

including removal of portion of existing platforms, is incidental to this repair item. The quantity of this repair will be measured as Each repair location.

- C. **Repair R1A – Vegetation Removal:** Refer to Contract Plans for repair details. Remove loose vegetation from surface of walls and anchorages, taking care to not damage masonry, mortar, or other structural elements. Also remove vegetation from ground in immediate vicinity of walls and anchorage to limit future growth onto the structure. Apply a commercially available, non-toxic, wide range weed killer to any remaining vegetation on structure. Verify that the weed killer does not cause discoloration or otherwise damage the structure in any way prior to use. Follow all manufacturers' directions and precautions during and after use of weed killer. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- D. **Repair R1B – Mortar Repointing:** Refer to Contract Plans for repair details. Repair mortar is to match color of existing mortar, to the satisfaction of the Engineer. Clean joints of all loose scale, dirt, other foreign matter, or loosely stuck particles of existing mortar prior to application. Provide a neat, uniform finish consistent with finish of existing mortar joints to satisfaction of the Engineer. Clean any extraneous mortar from the face of the masonry after completion of repointing. Take care to not damage stone during repointing or cleaning. Follow manufacturer's recommendation for application of mortar to ensure proper adhesion and curing. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair is Linear Feet.
- E. **Repair R2A – Banding Strap Spacer:** Refer to Contract Plans for repair details. Steel banding strap and shim dimensions are to be determined by contractor based on field measurements as required. Dimensions are to be similar to existing strap and shim except that the banding strap bolt location is to be lower to avoid contact with the adjacent banding strap. Provide high strength epoxy adhesive compatible with banding strap shim material to connect shim to strap. All labor and material necessary to complete this repair, including any temporary support of floorbeam during the repair, is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- F. **Repair R2B – Banding Strap Shim Replacement:** Refer to Contract Plans for repair details. Field measure thickness and width of existing shim material. Match approximate dimensions of new shim material to existing to ensure a secure fit. Provide high strength epoxy adhesive compatible with banding strap shim material to connect shim to strap. All labor and material necessary to complete this repair, including any temporary support of floorbeam during the repair, is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- G. **Repair R3 – Stay cable – Hanger Swivel Coupler:** Refer to Contract Plans for repair details. Also refer to bullet II of this Special Provision for Swivel Coupler with Neoprene Lining. Paint to match hanger rods (blue). Coordinate this repair with Repair

- L5 – Stay Cable Replacement. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- H. **Repair R4A – Wear Pad: Hanger Railing Brace:** Refer to Contract Plans for repair details. Also refer to bullets JJ and KK of this Special Provisions for Vinyl Ester Resin Wear Pad and High Strength Epoxy Adhesive. Paint pads and clamps the same color as bridge member to which they are attached. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- I. **Repair R4B – Wear Pad: FLBM EXTN/Hanger:** Refer to Contract Plans for repair details. Elastomeric pads shall meet the requirements of Section 715.15 of the Standard Specifications except the thickness shall be as shown on plans. Use epoxy adhesive compatible with wear pads as recommended by epoxy manufacturer. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- J. **Repair R4C – Wear Pad: Stay Cable Retrofit Rod:** Refer to Contract Plans for repair details. Also refer to bullets JJ and KK of this Special Provisions for Vinyl Ester Resin Wear Pad and High Strength Epoxy Adhesive. Paint pads and clamps the same color as bridge member to which they are attached. Coordinate this repair with Repair L5 – Stay Cable Replacement. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- K. **Repair R4D – Wear Pad: Stay Cable/Railing Brace:** Refer to Contract Plans for repair details. Also refer to bullets JJ and KK of this Special Provisions for Vinyl Ester Resin Wear Pad and High Strength Epoxy Adhesive. Paint pads and clamps the same color as bridge member to which they are attached. Coordinate this repair with Repair L5 – Stay Cable Replacement. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- L. **Repair R4E – Wear Pad: Hanger/Stay Cable Retrofit Rod:** Refer to Contract Plans for repair details. Also refer to bullets JJ and KK of this Special Provisions for Vinyl Ester Resin Wear Pad and High Strength Epoxy Adhesive. Paint pads and clamps the same color as bridge member to which they are attached. Coordinate this repair with Repair L5 – Stay Cable Replacement. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- M. **Repair R4G – Suspension Cable Spacer:** Refer to Contract Plans for repair details. Steel spacer dimensions are to be determined by contractor based on field measurements. Dimensions shall be similar to existing spacer except that the spacer will be relocated to avoid interference with stay cables. Field measure/verify banding strap

- and lining dimensions to ensure a tight and secure fit of the strap on the suspension cable. Provide high strength epoxy adhesive compatible with the neoprene lining as recommended by lining manufacturer. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- N. **Repair R5 – Truss Broken Washer Replacement:** Refer to Contract Plans for repair details. Also refer to bullet LL of this Special Provision for Ogee Washer and Nut. All labor and material necessary to complete this repair, including temporary support of any element necessary to complete the repair, is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- O. **Repair R6 – Truss Shim Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair, including temporary support of any element necessary to complete the repair, is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- P. **Repair R7 – FLBM EXTN/Truss Rod Stay Plate Bolt Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- Q. **Repair R8 – FLBM/Strut Bolt Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- R. **Repair R9A – Bearing Modification Tower 1:** Refer to Contract Plans for repair details. Previous inspections have indicated the Tower 1 bearings may currently be sitting in a contracted position at temperatures where it is expected that the bearing would be expanded or neutral. As part of this repair, bearings shall be reset to neutral position (top pin vertically above bottom pin) for an air temperature between 60 and 75 degrees Fahrenheit. Field measure Dimension “A” as shown on contract plans when the air temperature is between 60 and 75 degrees Fahrenheit. This dimension shall be taken from the end of the existing sole plate to centerline bearing, where centerline bearing is taken as the center of the existing masonry plate (this should align with the centerline of the notch for the bottom pin). If at time of measurement, when the temperature is between 60 and 75 degrees Fahrenheit, the bearing is not in contracted position (top pin rotated toward center of bridge), consult with Engineer prior to fabrication. All labor and material necessary to complete this repair, including jacking, temporary support, bridge seat cleaning and steel cleaning is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- S. **Repair R9B – Bearing Modification Tower 2:** Refer to Contract Plans for repair details. Previous inspections have indicated the Tower 2 bearings may currently be sitting in an expanded position at temperatures where it is expected that the bearing would be contracted or neutral. As part of this repair, bearings shall be reset to neutral

- position (top pin vertically above bottom pin) for an air temperature between 60 and 75 degrees Fahrenheit. Field measure Dimension “A” as shown on contract plans when the air temperature is between 60 and 75 degrees Fahrenheit. This dimension shall be taken from the end of the existing sole plate to centerline bearing, where centerline bearing is taken as the center of the existing masonry plate (this should align with the centerline of the notch for the bottom pin). If at time of measurement, when the temperature is between 60 and 75 degrees Fahrenheit, the bearing is not in expanded position (top pin rotated toward backwall), consult with Engineer prior to fabrication. All labor and material necessary to complete this repair, including jacking, temporary support, bridge seat cleaning and steel cleaning is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- T. **Repair R10A – Steel Grid Deck – Spot Weld Repair:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
 - U. **Repair R10B – Steel Grid Deck – Bar Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
 - V. **Repair R11 – Deck Seal Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
 - W. **Repair R13 – Sidewalk Panel Realignment:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
 - X. **Repair R14 – End Lateral Bracing Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair, including patch material for the stainless steel drainage deflector is incidental to this repair item. The quantity of this repair will be measured in Pounds.
 - Y. **Repair R16 – Plate Washer Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair, including temporary support of any element necessary to complete the repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
 - Z. **Repair L1 – Tower Undercutting Mitigation:** Refer to Contract Plans for repair details. Refer to FHWA Publication No. FHWA-NHI-09-111, Hydraulic Engineering Circular No. 23, for particle size limits for the specified class of rip rap. Sections 218.3.2 and 704.2 of the Standard Specifications shall also apply for rip rap. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.

- AA. **Repair L2 – Anchorage Housing Repair:** Refer to Contract Plans for repair details. Meet applicable requirements of Section 601 and 602.

Use a high strength, two component, non-shrink, epoxy based adhesive specifically formulated for anchoring and dowelling rebar when drilling and epoxying bars into existing stone. Epoxy shall be dispensed through a nozzle that homogeneously mixes the material without hand mixing. Obtain approval of the epoxy material from the Engineer prior to use and follow all manufacturers' recommendations during use to ensure a secure anchorage is achieved. Take care to not damage stone outside limits of repair.

Provide an epoxy bonding compound conforming to ASTM C 881 specifically formulated to bond freshly mixed concrete to hardened concrete or stone. Obtain approval of the material from the Engineer prior to use. Apply the compound according to manufacturers' recommendations.

Follow all provisions of Repair R1B – Mortar Repointing for repointing of mortar under this repair item, except repointing within this item is incidental to the anchorage housing repair.

All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.

- BB. **Repair L3 – Lateral Stay Cable Anchorage Repair:** Refer to Contract Plans for repair details. Meet applicable requirements of Section 601 and 602.

Use a high strength, two component, non-shrink, epoxy based adhesive specifically formulated for anchoring and dowelling rebar when drilling and epoxying bars into existing stone. Epoxy shall be dispensed through a nozzle that homogeneously mixes the material without hand mixing. Obtain approval of the epoxy material from the Engineer prior to use and follow all manufacturers' recommendations during use to ensure a secure anchorage is achieved. Take care to not damage stone outside limits of repair.

Provide an epoxy bonding compound conforming to ASTM C 881 specifically formulated to bond freshly mixed concrete to hardened concrete or stone. Obtain approval of the material from the Engineer prior to use. Apply the compound according to manufacturers' recommendations.

Follow all provisions of Repair R1B – Mortar Repointing for repointing of mortar under this repair item, except repointing within this item is incidental to the stay cable anchorage repair.

All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.

- CC. **Repair L4 – Lateral Stay Cable Replacement:** Refer to Contract Plans for repair details. Replace lateral stay cables at all locations on the bridge as indicated in the Contract Plans. Paint new lateral stay cables to match existing lateral stay cables in accordance with the Coating Details sheets in the Contract Plans. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Lump Sum.

- DD. **Repair L5 – Stay Cable Replacement:** Refer to Contract Plans for repair details. Replace stay cables at all locations on the bridge as indicated in the Contract Plans. Paint new stay cables to match existing stay cables in accordance with the Coating Details sheets in the Contract Plans. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Lump Sum.
- EE. **Repair L6A – Timber Truss Repair:** Refer to Contract Plans for repair details. Caulking material shall be compatible with the wood and paint system being applied, and shall be as recommended by the paint manufacturer in writing. Present the caulking material and recommendation to the Engineer for approval prior to use. Follow all manufacturers' recommendations for application of caulking, including any environmental restrictions. Caulking shall not be applied when it is raining or when the wood is wet. Clean any loose debris from the checks and cracks prior to application. Apply the caulk in a neat, smooth line approximately even with the wood surface such that, once painted along with the wood, the caulking will not be readily apparent. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured in Linear Feet.
- FF. **Repair L6B – Timber Truss Splice Replacement:** Refer to Contract Plans for repair details. All labor and material necessary to complete this repair, including temporary support is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- GG. **Repair L8 – Saddle Access Hatch Repair:** Refer to Contract Plans for repair details. Any material replaced for resetting the hatch shall be similar in nature to the material being replaced. Replacement hardware shall be galvanized or stainless steel. All components of reset hatch shall be painted to match the remainder of the tower cap and access hatch. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- HH. **Repair L11 – Decorative Globe Replacement:** Refer to Contract Plans for repair details. Replace missing decorative globe as indicated in the Contract Plans. Paint new globe to match other existing globes in accordance with the Coating Details sheets in the Contract Plans. All labor and material necessary to complete this repair is incidental to this repair item. The quantity of this repair will be measured as Each repair location.
- II. **Swivel Coupler with Neoprene Lining:**
- a. **Description of Work:** Install swivel couplers at intersecting cable locations indicated in the Contract Plans.
 - b. **Material Requirements:** Provide forged steel scaffold swivel clamps compatible with varying diameters of hangers and stay cables. Account for neoprene pad thickness when determining diameter. Clamps are to securely fit in place and securely hold neoprene lining in place. Use clamps manufactured

by Universal Manufacturing, 550 West New Castle Street, Zelienople, PA, or an approved equal.

A swivel clamp shall consist of:

- i. One male and one female forged steel body made from low carbon steel, joined together by a center rivet 5/8" diameter x 1" long
- ii. Two forged steel caps made from medium carbon steel
- iii. Body and caps hot-dipped galvanized
- iv. Four rivets, 2 x 3/8" diameter, 2 x 7/16" diameter, zinc plated and clear passivated
- v. Two eyebolts 9/16" UNC12
- vi. Two shoulder nuts 9/16" UNC12 x 7/8" A/F Hex, eyebolts and shoulder nuts zinc plated and dichromate passivated

The above listed parts shall be assembled into complete units with the caps and eyebolts hinged to the body by use of the rivets such that the cap will not open more than 90 degrees.

With an applied and sustained load of 1349 lb/SF, rotation must not exceed 0.275".

With an applied and sustained load of 1911 lb/SF, the clamp must not slip more than 0.020".

With the clamp resting on a fixed support on the vertical tube, thus preventing it from slipping, it must withstand an applied and sustained load of 3822 lb/SF without distorting such that it will be rendered unsuitable for subsequent use.

c. **Construction Requirements:**

Remove and replace existing clamps one at a time. Properly dispose of existing clamps.

Securely install new clamps one at a time at locations as indicated on Contract Plans. Provide neoprene lining between clamp and cable. Secure neoprene lining to cable with epoxy adhesive. Tighten clamps such that the neoprene lining is securely held in place.

Paint swivel couplers in accordance with Contract Plans and Special Provisions

- d. **Payment:** The cost of swivel couplers, epoxy adhesive, and neoprene lining pads is incidental to ITEM 615075-002, Miscellaneous Bridge Work, Repair R3 – Stay Cable-Hanger Swivel Coupler.

JJ. **Vinyl Ester Resin Wear Pad:**

- a. **Description of Work:** Install Vinyl Ester Resin Wear pads at locations indicated in Contract Plans.
- b. **Materials:** Provide Vinyl Ester Resin Wear Pads specifically designed to prevent metal-to-metal contact such as ProTek Wear Pads manufactured by

Advanced Piping Products Inc., 5611 Guhn Rd. Suite A1, Houston, Texas, or an approved equal.

Vinyl Ester Resin Wear Pads shall be glass reinforced with a minimum Barcol Hardness of 50 when tested in accordance with ASTM D2583. Pads shall be molded to size, with the wear pad inside diameter molded to within 1/8 inch of the outside diameter of the member receiving the pad. Inside face of pad shall be pre-roughened to provide high epoxy-to-wear pad bonding strength. Wear pad molded thickness shall be 1/4 inch unless otherwise noted on the plans.

- c. **Construction Requirements:** Install as indicated on Contract Plans and in accordance with wear pad and adhesive manufacturers' recommendations. Pads shall be painted to match member to which they are applied after installation. Follow coatings manufacturer's recommendations to assure proper paint adhesion to the pad.

Grinding of the pads is only permitted if sufficient clearance is not provided between the member receiving the pad and the abrasion surface. If grinding of the pad is required, the minimum thickness of the pad shall be 1/8 inch. Grinding of the pads is only permitted with prior approval of the Department Representative.

- d. **Payment:** The cost of Vinyl Ester Resin Wear Pads is incidental to the individual repair items in which they are used.

KK. High Strength Epoxy Adhesive:

- a. **Description of Work:** High strength epoxy adhesive is to be used to bond Vinyl Ester Resin Wear Pads to bridge components as indicated in the Contract Plans and Special Provisions.

- b. **Materials:** Provide High Strength Epoxy Adhesive compatible with Vinyl Ester Resin Wear Pad as recommended by wear pad manufacturer. Epoxy Resin shall be specifically formulated to bond composite material to a painted metallic surface.

High Strength Epoxy Adhesive shall have a minimum single-lap shear strength of 2500 psi at failure when tested in accordance with ASTM D1002. The epoxy shall be able to withstand large loads in multiple directions without losing adhesion integrity.

- c. **Construction Requirements:** Apply adhesive to the contact face of the adjoining elements as per manufacturer's instructions, and then securely clamp with 1/2" wide stainless steel hose clamps to allow proper curing. Once clamped, apply additional adhesive to the joint between the wear pad and bridge component to eliminate gaps and prevent water intrusion. Leave clamps in place upon completion, and paint to match the wear pad and bridge component to which the pad is attached.

- d. **Payment:** The cost of the High Strength Epoxy Adhesive and stainless steel clamps is incidental to the individual repair item in which they are used.

LL. Ogee Washer and Nut:

- a. **Description:** Replace existing damaged Ogee Washers at locations indicated in the Contract Plans.
- b. **Materials:** Provide Ogee Washers typically used in wood construction with an oversized bearing surface designed to prevent bolt heads and nuts from pulling into wood. Size and shape of new ogee washer shall match existing ogee washer that is being replaced. Also provide new hex nut compatible with truss vertical steel rod and new washer. Washer and nut shall be hot-dipped galvanized.
- c. **Construction Requirements:** Install as indicated on Contract Plans and in accordance with washer manufacturers' recommendations. Washer and nut shall be painted after installation the same color as the components they are replacing. Refer to Contract Plans and Special Provisions for painting requirements of galvanized components.
- d. **Payment:** The cost of the Ogee Washer and nut is incidental to Item 615075-002, Miscellaneous Bridge Work, Repair R5 – Truss Broken Washer Replacement.

615.7-MEASUREMENT AND PAYMENT:

ADD THE FOLLOWING SUBSECTION:

615.7.4-Miscellaneous Bridge Work: Repairs with the unit of Each or Lump Sum will be measured as the complete repair including all labor, tools, equipment, repair materials, supplies, falsework or any other temporary support, jacking, access and other incidentals necessary to complete the repair. It is the Contractor's responsibility to determine all incidental costs associated with a repair and reflect these costs in his bid. Incidental material quantities provided in the Contract Plans for each repair are for the contractor's information only and may be approximate.

The quantity of Repair L6A – Timber Truss Repair will be measured as Linear Feet of caulk/filler applied. All labor, tools, equipment, repair material, supplies, access, and incidentals necessary for the application of the caulk/filler is incidental to this item.

The quantity of Repair R1B – Mortar Repointing will be measured as Linear Feet of mortar applied. All labor, tools, equipment, repair materials, supplies, falsework, access, and incidentals necessary for the application of the mortar is incidental to this item.

The quantity of Repair R14 – End Lateral Bracing Replacement will be measured as Pounds of structural steel in accordance with Section 615. All labor, tools, equipment, repair materials, supplies, falsework, access, and incidentals necessary for installation of the lateral bracing and repair of the drainage deflector is incidental to this item.

615.8-BASIS OF PAYMENT:

ADD THE FOLLOWING SUBSECTION:

615.8.1-Miscellaneous Bridge Work: The quantities, determined as provided above, will be paid for at the contract unit prices bid for the items listed below, which prices and payments shall be full compensation for furnishing all material and doing all the work prescribed for a workmanlike and acceptable manner including all labor, tools equipment, repair materials, supplies, falsework or any other temporary support, jacking, access, and incidentals necessary to complete the work.

615.9-PAY ITEMS:

ADD THE FOLLOWING SUBSECTION:

615.9.1-Miscellaneous Bridge Work:

ITEM	DESCRIPTION	UNIT
615075-002	Miscellaneous Bridge Work, Repair C2A – Navigation Light Platforms Configuration 1	Each
615075-002	Miscellaneous Bridge Work, Repair C2B – Navigation Light Platforms Configuration 2	Each
615075-002	Miscellaneous Bridge Work, Repair R1A – Vegetation Removal	Each
615075-003	Miscellaneous Bridge Work, Repair R1B – Mortar Repointing	Linear Feet
615075-002	Miscellaneous Bridge Work, Repair R2A – Banding Strap Spacer	Each
615075-002	Miscellaneous Bridge Work, Repair R2B – Banding Strap Shim Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair R3 – Stay Cable – Hanger Swivel Coupler	Each
615075-002	Miscellaneous Bridge Work, Repair R4A – Wear Pad: Hanger/Railing Brace	Each
615075-002	Miscellaneous Bridge Work, Repair R4B – Wear Pad: FLBM EXTN/Hanger	Each
615075-002	Miscellaneous Bridge Work, Repair R4C – Wear Pad: Stay Cable Retrofit Rod	Each
615075-002	Miscellaneous Bridge Work, Repair R4D – Wear Pad: Stay Cable/Railing Brace	Each
615075-002	Miscellaneous Bridge Work, Repair R4E – Wear Pad: Hanger/Stay Cable Retrofit Rod	Each
615075-002	Miscellaneous Bridge Work, Repair R4G – Suspension Cable Spacer	Each
615075-002	Miscellaneous Bridge Work, Repair R5 – Truss Broken Washer	Each

	Replacement	
615075-002	Miscellaneous Bridge Work, Repair R6 – Truss Shim Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair R7 – FLBM EXTN/Truss Rod Stay Plate Bolt Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair R8 – FLBM/Strut Bolt Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair R9A – Bearing Modification Tower 1	Each
615075-002	Miscellaneous Bridge Work, Repair R9B – Bearing Modification Tower 2	Each
615075-002	Miscellaneous Bridge Work, Repair R10A – Steel Grid Deck – Spot Weld Repair	Each
615075-002	Miscellaneous Bridge Work, Repair R10B – Steel Grid Deck - Bar Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair R11 – Deck Seal Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair R13 – Sidewalk Panel Realignment	Each
615001-002	Steel Superstructure, Repair R14 – End Lateral Bracing Replacement	Pounds
615075-002	Miscellaneous Bridge Work, Repair R16 – Plate Washer Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair L1 – Tower Undercutting Mitigation	Each
615075-002	Miscellaneous Bridge Work, Repair L2 – Anchorage Housing Repair	Each
615075-002	Miscellaneous Bridge Work, Repair L3 – Lateral Stay Cable Anchorage Repair	Each
615075-002	Miscellaneous Bridge Work, Repair L4 – Lateral Stay Cable Replacement	Lump Sum
615075-002	Miscellaneous Bridge Work, Repair L5 – Stay Cable Replacement	Lump Sum
615075-003	Miscellaneous Bridge Work, Repair L6A – Timber Truss Repair	Linear Feet
615075-002	Miscellaneous Bridge Work, Repair L6B – Timber Truss Splice Replacement	Each
615075-002	Miscellaneous Bridge Work, Repair L8 – Saddle Access Hatch Repair	Each
615075-002	Miscellaneous Bridge Work, Repair L11 – Decorative Globe Replacement	Each

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT NUMBER: _____

FEDERAL PROJECT NUMBER: _____

**SECTION 688
FIELD PAINTING OF METAL STRUCTURES**

688.1-DESCRIPTION:

ADD THE FOLLOWING SUBSECTION:

688.1.1-Wheeling Suspension Bridge: The painting (coating) of the Wheeling Suspension Bridge shall follow the requirements set forth in this Special Provision and the Contract Plans. Where information contained in Section 688 of the Specifications contradicts information in this Special Provision and the Contract Plans, the information in this Special Provision and the Contract Plans takes precedence. Information contained in Section 688 of the Specifications that is not specifically addressed in this Special Provision or the Contract Drawings is applicable.

SECTION A

**TECHNICAL SPECIFICATION FOR SURFACE PREPARATION AND REPAINTING
OF WHEELING SUSPENSION BRIDGE**

PART 1.0 – GENERAL

1.01 DESCRIPTION

- A. This Section provides the material and workmanship requirements for the field surface preparation and repainting of the Wheeling Suspension Bridge. All work shall be performed in accordance with this Section and the project plans and drawings. Section B of this Specification provides the worker protection, environmental protection, and hazardous waste disposal requirements with which the Contractor shall comply.

B. Scope of Work – The bridge surfaces scheduled for painting work are categorized below. The Coating System Summary Table (See Appendix A) is a guide only that identifies the Parts of this Section that address the specific surface preparation and paint requirements for those surfaces.

1. Bridge Cables and Hanger Rods. Includes all hanger rod assemblies, stay cables, lateral sway cables across the bridge, and all suspension cable sections enclosed within transverse wire wrapping in Spans 1, 2, & 3. The stay cables and lateral sway cables will be replaced with new cables. Work includes hand tool cleaning and application of a two-coat acrylic paint system.
2. Thin Gage Metals. Includes all thin gage metal surfaces of the suspension cable sections within banded metal housings in Spans 1, 2, & 3 and the east and west tower caps, including the saddle access hatches and decorative globes. Work includes abrasive vapor blast cleaning and application of a two-coat acrylic paint system.
3. Ornamental Bridge Surfaces. Includes all wrought iron sidewalk railings in Span 1, the I-beam arches located in Span 1 at the base of the West Tower and in Span 3 at the base of the East Tower. Work include pressure water cleaning with supplemental hand/power tool cleaning and application of a spot coat of acrylic plus two full coats of acrylic.
4. Timber (Wood) Stiffening Trusses. Includes all timber (wood) stiffening truss surfaces in Span 2 and all miscellaneous metal elements attached to those timbers including, but not limited to, the railing braces, tie anchor and rod assemblies holding the timbers together, and the mesh panel sections attached along sidewalk faces of the trusses. Work includes abrasive vapor blast cleaning, supplemental hand and/or power sanding as needed, and the application of a three-coat paint system.
5. Framing Steel. Includes all below deck framing steel surfaces at Panel Points 0 through 6 on the west end of Span 2 and Panel Points 123 through 124 on the east end of Span 2. Work includes spot power tool cleaning and the application of a spot coat of organic zinc primer plus two full coats of acrylic.
6. Lateral Sway Cable Anchorages. Includes all steel surfaces of the four Lateral Sway Cable Anchorage structures located on the upstream and downstream sides on both ends of the bridge, including interior surfaces and retrofits at the northeast anchorage. Work includes abrasive blast cleaning and the application of a three-coat system consisting of an organic zinc primer, an epoxy intermediate coat and a polyurethane finish coat.

7. Miscellaneous Painting Work. As a part of other bridge repair items, new surfaces such as vinyl ester wear plates, galvanized swivel couplers on hangers, galvanized bolt assemblies, and new shop primed steel (i.e., light posts, sole plates at bearing areas) will be added to the bridge. The Contractor shall field clean and paint those surfaces as shown on the project plans (“Repair Item Painting Notes” contained on Plan/Drawing Sheet 47 of 47, “Rehabilitation Coating Repair Details”).
 - C. The Contractor is required to implement and maintain programs and procedures which comply with the requirements of this Section and Section B and all applicable Federal, state, and local OSHA and EPA standards and regulations. The Contractor is cautioned that it must comply with all applicable regulations even if the regulation is not specifically referenced herein. If a state or local regulation is more restrictive than the requirements of this Section and Section B, the more restrictive requirements prevail.
 - D. Samples of the existing coating system to be removed have been collected and analyzed for the presence of toxic metal concentrations (lead, cadmium, and chromium). Be advised that this analysis indicated that concentrations of toxic metals were detected in the existing coatings. This information is provided for information only. The Contractor shall be responsible for collecting coating system samples of their own, having these samples analyzed by a qualified testing agency for lead, cadmium, chromium, and hexavalent chromium, and complying with all Federal, State, and local regulations for worker protection, waste handling, testing, and disposal.
 - E. The term “Division” as used throughout this section represents the West Virginia Department of Highways (WVDOH) or its authorized representative.
- 1.02 REFERENCE STANDARDS** – The latest edition of the following standards and regulations form a part of this Specification.
- A. **American Society for Testing and Materials (ASTM)**
 1. ASTM D4138, Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means
 2. ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air
 3. ASTM D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages
 - B. **The Society for Protective Coatings (SSPC)**

1. SSPC-SP 1, Solvent Cleaning
2. SSPC-SP 2, Hand Tool Cleaning
3. SSPC-SP 3, Power Tool Cleaning
4. SSPC-SP WJ-4, Waterjet Cleaning of Metals – Light Cleaning
5. SSPC-SP 10, Near White Blast Cleaning
6. SSPC-SP 15, Commercial Grade Power Tool Cleaning
7. SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages
8. SSPC-VIS 3, Visual Standard for Power- and Hand-Tool Cleaned Steel

C. Code of Federal Regulations (CFR)

1. 29 CFR 1910, Occupational Safety and Health Regulations for General Industry
2. 29 CFR 1926, Occupational Safety and Health Regulations for the Construction Industry

D. Equipment and Coating Manufacturers' Published Instructions

E. Related Sections

1. Section B, Technical Specification for the Removal of Lead Based Paint
2. All Project Plans and Drawings

1.03 CONTRACTOR QUALIFICATIONS AND EXPERIENCE

- A.** Five (5) years of successful industrial painting experience with a minimum of three projects in the last two years involving a similar scope of work regarding surface preparation; surface preparation inspection; coating application and coating application inspection.
- B.** The Contractor shall have SSPC-QP 1 and QP2 certifications in effect at the time of bidding and throughout the project.

- C. The Contractor is responsible for supervising and directing the work efficiently using the best skills and attention, and is solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- D. Keep an experienced, competent resident superintendent acceptable to the Division on the jobsite at all times. Do not replace the superintendent except under extraordinary circumstances, and only upon approval of the Division.
- E. The superintendent is the Contractor's representative at the site and must have the authority to act on behalf of the Contractor. All communications given to the superintendent are binding upon the Contractor.

1.04 SUBMITTALS

A. Submittal Schedule

1. Submittals shall be forwarded through the Prime Contractor and be accepted prior to commencement of the subject work. This is the responsibility of both the Field Contractor and also the Shop Fabricator when new shop cleaned and primed steel is supplied.

B. Surface Preparation/Painting Plan

1. Provide written procedures for surface preparation and coating application on all surfaces identified in Parts 1.01.B.1 through 1.01.B.7 of this Section, including touch-up procedures for all coating systems. Include procedures for the application of caulk/sealant materials to timber stiffening truss sections of the bridge and a description of all surface preparation and paint application equipment to be used.
2. Identify the methods or work isolation procedures that will be followed to protect surrounding structures, property, equipment, other craft workers and all other persons that may be present from exposure to surface preparation and paint debris. Include methods that will be followed to store, handle, and dispose of project debris.
3. Identify the abrasive media to be used and the coating materials and caulk/sealant materials to be applied. Include manufacturer's name, product trade name, and product number. Provide material product data sheets, VOC levels, safety data sheets, and written application instructions including mixing requirements, specified thinners, and thinner amounts. Include a letter from the coating manufacturer indicating that the proposed caulk/sealant is compatible with the coating system being applied.
4. Provide proof of SSPC-QP 1 and QP 2 certification.

C. Worker Protection/Safety Program

1. Provide a comprehensive, written, safety program for the protection of all Contractor, Subcontractor, other craft employees, and all other persons that may be present from project hazards.

D. Work Schedule

1. Provide the construction schedule for mobilization, surface preparation, painting, and demobilization. Identify the start date and duration of each activity in calendar days. Include any dependencies or conditions that affect the schedule.

E. Engineer Review of Submittals

1. Do not construe Engineer acceptance of Contractor submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of this Section or Section B, or to adequately protect the health and safety of all workers involved in the project including any member of the public who may be affected by the project.
2. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices and adherence to them.

1.05 WORKER PROTECTION/SAFETY

- A. The Contractor is responsible for the safety of the work under its direct control and supervision.
- B. The Contractor is responsible for the health and safety of its employees. Develop an approved safety and health program for all Contractor employees and subcontractors consistent with the requirements of this Section and Section B.
- C. Due to the fall potentials associated with this project, pay specific and special attention to fall prevention, and compliance with OSHA regulations.
- D. Keep the work area in a clean, neat, and safe condition.
- E. Maintain accurate record files on accidents, occupational illnesses, fatalities, or OSHA citations.
- F. The Division has the right to examine the site of any accident and to question any person having knowledge of any such accidents. The Division has the right, but

not a duty, to inspect to ensure that the safety and health requirements under this contract are being implemented and fulfilled. If inspections reveal deficiencies, immediately take action as may be required to correct the deficiencies. If Contractor fails or refuses to correct an unsafe or unhealthful condition, the Division has the right to stop all or part of work performed until satisfactory corrective action has been taken. The Division will not be subject to claims by Contractor, its employees or its subcontractors as a result of this stop work order. The Division maintains the right to remove any person(s) from the site if, in the opinion of the Division, those person(s) endanger the safety or health of others.

- G.** Equip personnel with safety clothing, including shoes with non-sparking soles, and proper respiratory protection as required for the work. Provide explosion proof lighting, fans, pumps, sprayers, flashlights, etc. in all painting and curing areas.
- H.** Prohibit smoking, matches, lighters, or other spark/flame producing items in the painting, curing, or storage areas. Provide and maintain adequate ventilation during surface preparation, coating application, and curing phases of work to adequately remove dust and fumes to prevent injury to workmen or accumulation of volatile gases.

1.06 USE OF PREMISES

- A.** Confine apparatus, material storage, and work operations to the limits prescribed by ordinances or permits, or as may be directed by the Division. Do not unreasonably encumber the premises.
- B.** Comply with and enforce any instructions of the Division, and local laws regarding signs, advertising, fire, and smoking.
- C.** Maintain the job site in a clean and safe condition.

PART 2.0 – PRODUCTS

2.01 PROTECTIVE COVERINGS AND CONTAINMENT

- A.** Provide protective coverings and containment materials in accordance with this Section and Section B, as needed, to prevent contamination of surrounding equipment or property, and to protect those surfaces that are not designated to be prepared and painted.

2.02 SURFACE PREPARATION AND PAINTING EQUIPMENT

- A.** Provide and use surface preparation and painting equipment as required to perform the work in accordance with the requirements of this Section and Section B. Provide all equipment needed to perform the work including the necessary

power supplies, even if the required equipment is not specifically designated in this Specification.

B. Conventional (Dry) Abrasive Blast Cleaning Equipment

1. Provide conventional (dry) abrasive blast cleaning equipment as needed to clean the surfaces as specified.
2. Use equipment that is well-maintained with properly sized pots, hoses, nozzles and all support equipment (e.g., compressors) as needed to perform the work as specified.
3. If recycled abrasive is used, provided appropriate equipment to clean the abrasive for reuse, including the removal of fine particulate and dust.

C. Specialized Abrasive Vapor Blast Cleaning Equipment

1. Provide vapor abrasive blast cleaning equipment such as EcoQuip®, GeoBlaster, Farrow Systems or an equivalent Division accepted alternate, and as needed to clean the surfaces as specified in this Section.
2. Provide clean, potable water for use with the vapor blast cleaning equipment.
3. Use equipment that is well-maintained and properly sized pots, hoses, nozzles and all support equipment (e.g., compressors) needed to perform the work as specified.

D. Pressure Water Cleaning Equipment

1. Provide pressure water cleaning equipment as needed to clean the surfaces as specified in this Section. The equipment shall be properly sized and capable of producing the water pressure necessary to perform the work as specified.

E. Abrasive Blast Media

1. For all abrasive blast cleaning operations, provide abrasives that are clean, dry, and sized properly to provide the surface profile depth as required by the coating manufacturer.
2. For conventional abrasive blast cleaning, provide expendable abrasives, recyclable steel grit, or a mixture of steel grit-shot abrasives that are clean, dry, and sized properly to provide the surface profile as specified by the coating manufacturer. Use abrasives that are compatible with the substrate being cleaned and that are acceptable to the Division. Abrasives shall conform to one of the following:

- a) SSPC-AB 1 for mineral and slag abrasives
 - b) SSPC-AB 3 for new or re-manufactured steel abrasives
3. When specialized vapor blast cleaning or high pressure water cleaning with abrasive injection is used, provide a finely graded non-metallic abrasive media such as crushed glass, garnet, walnut shells, etc. that is compatible with the equipment. The Contractor shall demonstrate to the Division that the proposed blast media is acceptable and capable of achieving the specified surface cleanliness and superficially roughening only of the thin gage metal surfaces as specified without deforming or warping those surfaces.

F. Hand and Power Tools

- 1. Provide brushes, discs, wheels, scrapers, descalers, sanders and sandpaper, and other equipment as needed to perform the work as specified.
- 2. Use equipment and materials that are clean and sized properly to accomplish the work, including the required surface profile when specified.
- 3. All power tools shall be equipped with vacuum-shrouding.

G. Spray Equipment

- 1. Provide airless spray, conventional spray or other spray equipment as required to perform the work as specified.
- 2. Use equipment that is clean and equipped with agitators and ancillary equipment as required, and is sized properly to perform the work as specified.

H. Brushes and Rollers

- 1. Provide brushes and rollers as required to perform the work as specified.
- 2. Use equipment that is clean, constructed of materials that will not be softened or deteriorated by the paint or solvents, that will not leave roller nap or bristles in the applied paint film, and which is sized properly to perform the work as specified.

2.03 MATERIALS

A. General

1. Use the specified coating system, including thinners and other additives.
2. Deliver paint materials to the project in sealed, original, labeled containers bearing manufacturer's name, type of material, brand name, color designation, shelf life, batch number, and instructions for mixing and thinning.
3. Upon the completion of the work, provide the Division with at least one unopened gallon of each type and color of product used. Tightly seal and clearly label each container for identification.

B. Coating Materials

1. Provide the type and quantity of coating materials needed to paint all the surfaces as specified, here in. Verify that all coating materials are VOC compliant.
2. The coating system(s) and products to be applied are categorized by the various substrates to be painted as detailed in Section 1.01.B. of this specification.
3. Use the same manufacturer for all coats of the specified systems, including thinners, additives, and touch-up paints. Do not co-mix paint products or components of different manufacturers under any circumstances.
4. Only use paint materials that are packaged in original sealed, labeled containers bearing the manufacturer's name, type of material, brand name, color designation, shelf life, batch number, and instructions for mixing and thinning.
5. Finish colors shall be as detailed on the plans and drawings. (See Drawing Sheet __ of __) Drawdown samples of all finish coat colors shall be submitted to the District for acceptance prior to ordering any finish materials.
6. The manufacturer's products shown in Parts 7 through 12 below are provided as examples of the types and quality of coating materials required. Alternate products of similar composition, application and performance characteristics may be submitted for consideration by the Division as an alternate. Ample documentation of equivalency must be provided. The decision of the Division to accept or reject the alternate material is final. All coats listed below are full overall coats over the specified surfaces, unless otherwise noted.
7. **Coating System 1A: (HB Elastomeric Acrylic/Acrylic)**
Surfaces Coated: Existing Bridge Cables and Hanger Rods

Mathys/Rustoleum Dry Thickness (mils)

Prime: Noxyde Tack Coat (Noxyde thinned 10-20%)	1.5 to 2.5
1 st Ct: Noxyde	7.0 to 14.0
2 nd Ct: 3700 DTM Acrylic	<u>2.0 to 3.0</u>
Total Thickness	10.5 to 19.5

3M ScotchKote (Formerly Thortex) Dry Thickness (mils)

Prime:	None
1 st Ct: Polynox 136	3.5 to 7.0
2 nd Ct: Polynox 136	<u>3.5 to 7.0</u>
Total Thickness	7.0 to 14.0

8. **Coating System 1B: (HB Elastomeric Acrylic/Acrylic)**
Surfaces Coated: New Bridge Cables

Mathys/Rustoleum Dry Thickness (mils)

Prime: Pegalink	1.0 to 2.0
1 st Ct: Noxyde	7.0 to 14.0
2 nd Ct: 3700 DTM Acrylic	<u>2.0 to 3.0</u>
Total Thickness	10.0 to 19.0

3M ScotchKote (Formerly Thortex) Dry Thickness (mils)

Prime: Uni-Tech MC Primer	1.5 to 2.5
1 st Ct: Polynox 136	3.5 to 7.0
2 nd Ct: Polynox 136	<u>3.5 to 7.0</u>
Total Thickness	8.5 to 16.5

9. **Coating System 2: (Acrylic/Acrylic)**
Surfaces Coated: Thin Gage Metals

Carboline Dry Thickness (mils)

1 st Ct: Carbocrylic 3359 DTM	3.0 to 5.0
2 nd Ct: Carbocrylic 3359 DTM	<u>3.0 to 5.0</u>
Total Thickness	6.0 to 10.0

International Paints Dry Thickness (mils)

1 st Ct: Devcryn 1440	2.0 to 3.0
2 nd Ct: Devcryn 1449	<u>2.0 to 3.0</u>

Total Thickness 4.0 to 6.0

<u>Pittsburgh Paints (PPG)</u>	<u>Dry Thickness (mils)</u>
1 st Ct: Amercoat 220P	2.0 to 3.0
2 nd Ct: Amercoat 220P	<u>2.0 to 3.0</u>
Total Thickness	4.0 to 6.0

<u>Sherwin Williams Paints</u>	<u>Dry Thickness (mils)</u>
1 st Ct: Pro-Industrial DTM Acrylic	2.0 to 4.0
2 nd Ct: Pro-Industrial DTM Acrylic	<u>2.0 to 4.0</u>
Total Thickness	4.0 to 8.0

10. **Coating System 3: (Acrylic Primer/Acrylic/Acrylic)**
Surfaces Coated: Ornamental Bridge Surfaces

<u>Carboline</u>	<u>Dry Thickness (mils)</u>
Spot Ct: Carbocrylic 3358 DTM	See Note Below
2 nd Ct: Carbocrylic 3359 DTM	3.0 to 5.0
3 rd Ct: Carbocrylic 3359 DTM	<u>3.0 to 5.0</u>
Total Thickness	6.0 to 10.0

<u>International Paints</u>	<u>Dry Thickness (mils)</u>
Spot Ct: Devcryn 1440	See Note Below
1 st Ct: Devcryn 1440	2.0 to 3.0
2 nd Ct: Devcryn 144	<u>2.0 to 3.0</u>
Total Thickness	4.0 to 6.0

<u>Pittsburgh Paints (PPG)</u>	<u>Dry Thickness (mils)</u>
Spot Ct: Amercoat 220P	See Note Below
1 st Ct: Amercoat 220P	2.0 to 3.0
2 nd Ct: Amercoat 220P	<u>2.0 to 3.0</u>
Total Thickness	4.0 to 6.0

<u>Sherwin Williams Paints</u>	<u>Dry Thickness (mils)</u>
Spot Ct: Pro-Cryl Universal Primer	See Note Below
1 st Ct: Pro-Industrial DTM Acrylic	2.5 to 4.5
2 nd Ct: Pro-Industrial DTM Acrylic	<u>2.5 to 4.5</u>
Total Thickness	5.0 to 9.0

Note: The Spot Primer Coat thickness does not require dry film thickness measurements.

11. **Coating System 4: (Acrylic Primer/Acrylic/Acrylic)**
Surfaces Coated: Timber (Wood) Stiffening Trusses and Attached Metal

<u>Carboline</u>	<u>Dry Thickness (mils)</u>
1 st Ct: Carbocoat 3358 DTM	3.0 to 5.0
2 nd Ct: Carbocrylic 3359 DTM	3.0 to 5.0
3 rd Ct: Carbocrylic 3359 DTM	<u>3.0 to 5.0</u>
Total Thickness	9.0 to 15.0

<u>Sherwin Williams Paints</u>	<u>Dry Thickness (mils)</u>
1 st Ct: Pro-Cryl Universal Primer	2.0 to 3.5
1 st Ct: Pro-Industrial DTM Acrylic	2.5 to 4.5
2 nd Ct: Pro-Industrial DTM Acrylic	<u>2.5 to 4.5</u>
Total Thickness	7.0 to 12.5

Caulk/sealant materials to be used in conjunction with the above wood paints systems to fill joints, cracks, crevices and gaps shall be a paintable, 100% acrylic or moisture cured urethane formulation as recommended by the paint manufacturer. Submit the proposed caulk/sealant material information to the Division for review and acceptance. Include a letter from the coating manufacturer indicating that the caulk/sealant material is suitable for the intended purpose and is compatible with their coating system.

12. **Coating System 5: Organic Zinc Primer/Acrylic/Acrylic**
Surfaces Coated: Framing Steel

<u>Carboline</u>	<u>Dry Film Thickness (mils)</u>
Spot Ct: Carbozinc 859	3.0 to 5.0
Spot Ct: Carbocrylic 3359 DTM	3.0 to 5.0
Spot Ct: Carbocrylic 3359 DTM	<u>3.0 to 5.0</u>
Total Thickness	9.0 to 15.0

<u>Pittsburgh Paints (PPG)</u>	<u>Dry Film Thickness (mils)</u>
Spot Ct: Amercoat 68HS	3.0 to 5.0
Spot Ct: Amercoat 220P	2.0 to 3.0
Spot Ct: Amercoat 220P	<u>2.0 to 3.0</u>
Total Thickness	7.0 to 11.0

<u>Sherwin Williams Paints</u>	<u>Dry Film Thickness (mils)</u>
Spot Ct: Zinc Clad III HS	3.0 to 5.0

Spot Ct: Pro-Industrial DTM Acrylic	2.5 to 4.5
Spot Ct: Pro-Industrial DTM Acrylic	<u>2.5 to 4.5</u>
Total Thickness	8.0 to 14.0

13. **Coating System 6: Organic Zinc Primer/Epoxy/Polyurethane**
Surfaces Coated: Lateral Stay Cable Anchorages

<u>Carboline</u>	<u>Dry Film Thickness (mils)</u>
1 st Ct: Carbozinc 859	3.0 to 6.0
2 nd Ct: Carboguard 893	3.0 to 6.0
3 rd Ct: Carbothane 133 VOC	<u>3.0 to 5.0</u>
Total Thickness	9.0 to 17.0

<u>Pittsburgh Paints (PPG)</u>	<u>Dry Film Thickness (mils)</u>
1 st Ct: Amercoat 68HS	3.0 to 5.0
2 nd Ct: Amercoat 399	4.0 to 8.0
3 rd Ct: Amercoat 450H	<u>2.0 to 5.0</u>
Total Thickness	9.0 to 18.0

<u>International Paints (PPG)</u>	<u>Dry Film Thickness (mils)</u>
1 st Ct: Interzinc 315B	2.0 to 6.0
2 nd Ct: Intergard 475HS	4.0 to 8.0
3 rd Ct: Interthane 870UHS	<u>3.0 to 5.0</u>
Total Thickness	9.0 to 19.0

<u>Sherwin Williams Paints</u>	<u>Dry Film Thickness (mils)</u>
1 st Ct: Zinc Clad III HS	3.0 to 5.0
2 nd Ct: Macropoxy 646 FC	3.0 to 10.0
3 rd Ct: Acrolon 218 HS	<u>3.0 to 6.0</u>
Total Thickness	9.0 to 21.0

2.04 PROTECTIVE COVERINGS

- A. Provide all protective coverings needed to protect those surfaces that are not designated to be prepared or coated.

2.05 CONTAINMENT MATERIALS

- A. Supply all materials needed to contain project debris in accordance with the requirements of this Section and Section B. This may include, but is not limited to, ground covers, scaffolding, and all other containment materials that may be

needed. Only use containment materials that are fire retardant.

- B. Use materials that are free of loose dust and debris when brought onto the project site, and upon removal.

2.06 WASTE CONTAINERS

- A. **Hazardous waste** – Comply with the requirements of this Section and Section B for collection, storage, and disposal of all hazardous waste.
- B. **Construction waste** – Provide all containers for non-hazardous construction waste. Use containers that are free of loose debris when brought on-site.
- C. **Spent solvents** – Provide all containers for spent solvents. Do not mix spent solvents with spent abrasives, paint debris, water, or other waste.

PART 3.0 - EXECUTION

3.01 PRE-PRODUCTION TEST AREAS

- A. In the presence of the Division and before proceeding with production surface preparation operations, the Contractor shall prepare and paint test areas for each surface specified in Parts 1.01.B.1 through B.6 of this Section. The test area sizes shall be as listed below and performed in locations considered by the Division to be representative of existing surface conditions and characteristics.
 - 1. Bridge Cables and Hangers – 3 lineal feet
 - 2. Thin Gage Metals – 6 square feet
 - 3. Ornamental Bridge Surfaces – 3 square feet each
 - 4. Timber Stiffening Truss – 9 square feet
 - 5. Framing Steel – Not applicable
 - 6. Lateral Sway Cable Anchorages – 6 square feet
- B. Prepare the test areas using the same equipment, materials, and procedures that will be used for production operations. Provide safe access for close visual inspection and testing by the Division. Do not proceed with production work until the Division agrees that each test area complies with the specified requirements and is acceptable.

3.02 INSPECTION OF CONDITIONS

- A. Prior to commencing work, inspect all surfaces to verify the suitability of the surfaces to be prepared and to receive paint. Report to the Division, in writing,

any condition that may affect proper surface preparation, coating application, or overall performance of the coating system. Do not proceed with work until the conditions have been corrected. Commencing work indicates acceptance of existing conditions and responsibility for performance of the applied coating.

3.03 CONTAINMENT AND PROTECTION OF SURFACES NOT TO BE COATED

- A.** Comply with the containment requirements of this Section and Section B.
- B.** Use extreme diligence to assure that surfaces not scheduled for coating work are protected against surface preparation damage, paint spillage, etc. by using protective coverings, shields, or masking materials. Pay particular attention to protect all bridge lighting apparatus running along the outside face of the timber trusses. The Contractor is responsible to make full restitution for damages caused by surface preparation and coating work, all at no additional cost to the Division.
- C.** Maintain all protective coverings during the entire period the work is being performed, and remove all coverings upon completion of the work.
- D.** Erect all scaffolding and staging required for the work and remove it upon project completion. Exercise extreme care in fastening, bracing, and handling the scaffolding and staging to avoid scratching or damaging surfaces and surrounding property. The Contractor is responsible for the repair of any damage created at no additional cost to the Division.

3.04 SURFACE PREPARATION – GENERAL REQUIREMENTS

A. Ambient Conditions

- 1. Do not conduct final surface preparation under damp environmental conditions or when the surface temperature is less than 5°F greater than the dew point temperature of the surrounding air.

B. Solvent Cleaning

- 1. Prior to using any of the methods of surface preparation specified herein, remove visible grease and oil from the surface.
- 2. SSPC-SP 1 Solvent/Detergent Cleaning
 - a) Clean the surface in accordance with SSPC-SP 1 to remove grease, oil, and other similar surface material. Only use solvents or detergents that will not damage the substrate, and that are acceptable to the coating manufacturer and Division. The Contractor shall collect, properly handle, and dispose of the

materials in accordance with all local, state, and federal regulations.

- b) Do not use hydrocarbon solvents for cleaning when acrylic coating systems are scheduled to be applied.
- c) Use clean cloths for the final wiping.

C. Compressed Air Cleanliness

- 1. Provide compressed air that is free from moisture and oil contamination.
- 2. Verify the cleanliness of the compressed air by the white blotter test in accordance with ASTM D4285 at least once per shift for each compressor system. Sufficient freedom from oil and moisture is confirmed if soiling or discoloration is not visible on the paper.
- 3. If air contamination is evident, change filters, clean traps, add moisture separators or filters, or make such adjustments as necessary to achieve clean, dry air. Inspect any surfaces which the contaminated compressed air may have contact for cleanliness and remove any contamination by solvent cleaning in accordance with SSPC-SP 1.

D. Cleaning After Surface Preparation

- 1. Following any of the surface preparation operations specified herein, remove all surface preparation debris, dust and dirt from the prepared surface by compressed air blow down, vacuuming, clean cloth wiping, or sweeping prior to painting.

3.05 SURFACE PREPARATION – SPECIFIC REQUIREMENTS - Comply with the specific surface preparation requirements for each surface scheduled for painting work as detailed below:

- A. Bridge Cables and Hanger Rods.** Prepare all bridge cables and hanger rods as identified in Part 1.01.B.1 of this Section by hand tool cleaning 100% of the surface area of each cable and hanger rod to remove all loose rust, loose paint and all other loose debris in accordance with SSPC-SP 2.
- B. Thin Gage Metals.** Prepare 100% of thin gage metal surfaces identified in Part 1.01.B.2 of this Section using a specialized low pressure vapor blast cleaning process as follows:
 - 1. Cleaning shall remove all existing coating, dirt, dust, metal oxides (corrosion products), and other foreign matter and superficially roughen

the metal surface. The superficial roughening shall form a continuous pattern, leaving no smooth, unroughened areas.

2. Care must be taken so that the thin gage metal surfaces are only superficially roughened and not warped, distended, distorted or otherwise damaged by the cleaning process. The Contractor shall be responsible for the repair or replacement of any surfaces damaged by the cleaning process at no additional cost to the Division
3. The Contractor shall demonstrate the cleaning process to the Division for acceptance while performing the Pre-Production Test Areas in accordance with Part 3.01 of this Section.
4. Verify that all surfaces are dry prior painting. Pay particular attention to crevices, gaps, pockets etc. where moisture may collect and take longer to dry.

C. Ornamental Bridge Surfaces. Prepare 100% of ornamental bridge surfaces as identified in Part 1.01.B.3 by pressure water cleaning at 3,000 to 5,000 psi with a 0° rotating tip on the pressure water cleaning gun to remove all loose rust, loose paint, and all other loose debris in accordance with SSPC-SP WJ 4, Light Cleaning.

1. Supplement pressure water cleaning, as needed, with spot hand and/or vacuum-shrouded power tool cleaning in accordance with SSPC-SP 2 or SP 3, respectively, in areas the pressure water cleaning process is not entirely effective for removing loose materials.
2. In addition to the cleaning specified above, 100% of the existing coating on the I-Beam Arches located in Spans 1 and 3 at the base of the East and West Bridge Towers shall be superficially roughened prior to painting. Roughening shall be performed by injecting abrasive into the pressure water stream or by hand and/or power sanding with finely graded sand paper. The roughening shall form a continuous pattern, leaving no smooth, unroughened areas.
3. A coating is considered to be tightly adhered if it cannot be removed by lifting with a dull putty knife. Feather-edge the periphery of all spot repair areas to provide a smooth coating transition into the surrounding intact coating system.
4. Verify that all surfaces are dry prior painting. Pay particular attention to crevices, gaps, pockets etc. where moisture may collect and take longer to dry.

- D. Timber (Wood) Stiffening Truss and Attached Metal Surfaces.** Prepare 100% of the Timber Stiffening Truss surfaces identified in Part 1.01.B.4 of this Section by abrasive blast cleaning using a specialized low pressure vapor blast cleaning process, supplemented by hand and/or power sanding as needed.
1. Wood Surfaces. Remove all loose coating, loose wood fibers and surface debris. Where bare wood is exposed, completely remove the thin surface layer of deteriorated, weathered, wood including any protruding or trayed wood fibers and surface dust prior to painting. Supplement the vapor blast cleaning process by hand and/or power sanding with a finely graded sandpaper as needed to prepare wood surfaces as specified above. If the blast cleaning process damages good wood fibers, stop work and notify the Division.
 2. Attached Metal Surfaces. Remove all loose rust, loose coating, and other loose debris from all metal surfaces attached to the timber members. A coating is considered to be tightly adhered if it cannot be removed by lifting with a dull putty knife. Feather-edge the periphery of all areas where loose rust or loose coating was removed to provide a smooth coating transition into the surrounding intact coating system.
 3. Prior to painting, verify that all wood surfaces are sufficiently dry by using a Delmhorst Moisture Detector in accordance with the manufacturer's published instructions. Moisture content within the "Green" area (15% moisture content or less) of the wood scale is considered sufficiently dry for painting. Pay particular attention to crevices, gaps, pockets etc. where moisture may collect and take longer to dry.
 4. Identify all cracks in timber and all joints, crevices and gaps between timbers and attached metal elements to which caulk/sealant is to be applied. The Contractor shall remove any existing loose or deteriorated caulk/sealant from those areas. Only intact, adherent caulking/sealant materials shall remain. Caulk/sealant shall be re-applied to those areas in accordance with Part 3.07.L. of this Section.
- E. Framing Steel.** Spot repair all areas of rust or deteriorated coating on the framing steel in the areas identified in Part 1.01.B.5 of this Section by power tool cleaning in accordance with SSPC-SP 15. Feather edge the periphery of all spot repair areas to provide a smooth transition into the surrounding intact coating system.
- F. Lateral Stay Cable Anchorages.** Prepare all steel surfaces of the Lateral Stay Cable Anchorages identified in Part 1.01.B.6 of this Section by near white abrasive blast cleaning in accordance with SSPC-SP 10.

3.06 MATERIAL STORAGE, MIXING, AND HANDLING

A. Material Storage

1. Keep all containers of paint unopened until required for use.
2. Store all paint materials, thinners, and solvents in accordance with OSHA regulations and the requirements of the paint manufacturer. Store the paint and solvents under cover, out of direct sunlight. Maintain the temperature between 50°F and 90°F, unless the requirements of the manufacturer are more restrictive.
3. Provide the size and number of fire extinguishers in proper proportion to the quantity of paint stored.
4. Do not permit smoking in paint storage, mixing, and application areas.
5. Do not open or mix paints in the storage area.
6. Do not return mixed paints to the storage area.
7. Bulk containers for solvents and thinners must be equipped with spring-loaded, self-closing, dispensing nozzles and Underwriter's Laboratories approved drum bung vents. Use Underwriter's Laboratories approved containers for transporting paint to mixing areas.
8. Use explosion-proof lighting fixtures.
9. Do not permit the accumulation of empty cans, combustibles, and other debris.
10. Maintain safety data sheets for all materials on site at all times during the project.

B. Mixing and Thinning of Coating Materials

1. Verify that the paint to be mixed has not exceeded its shelf life.
2. Utilize proper ventilation in the mixing area to prevent injury to workers or the accumulation of volatile gases.
3. Mix all coatings in accordance with the requirements of the coating manufacturer.
4. Mix only complete kits of material. Mixing of partial kits is not allowed.

5. Do not use two component materials beyond the pot life established by the manufacturer's written instructions.
6. Thin paints in strict accordance with the coating manufacturers written instructions. Use only those types, brands, and amounts of thinner recommended by the coating manufacturer. Limit the thinning to only the amount necessary to facilitate application.

3.07 COATING AND CAULK/SEALANT APPLICATION

- A. Surface Preparation** – Verify that the surface exhibits the specified degree of preparation immediately prior to painting.
- B. Surface Cleanliness** – Thoroughly clean the surface prior to the application of each coat to remove spent abrasive, dirt, dust, and other interference material.
- C. Grease/Oil** – If grease or oil have become deposited on the bare surface to be painted or on the surface of any of the applied coats, remove by solvent cleaning in accordance with SSPC-SP 1 prior to the application of the next coat.
- D. Ambient Conditions** – Apply all coatings under the following conditions unless the requirements of the coating manufacturer are more restrictive.
 1. Surface and Air Temperatures – Between 50°F and 110°F.
 2. Relative Humidity – Less than 90%.
 3. Dew Point – Surface temperature at least 5°F above the dew point temperature of the surrounding air.
 4. Frost/Rain – Do not apply coatings to surfaces containing frost or during rain, fog, or similar conditions.
 5. Remove and replace any paint that is exposed to unacceptable conditions (e.g. rain or dew) prior to adequate curing.
- E. Methods of Application** – Apply by brush, roller or spray application. Brush and roller application may require multiple coats to achieve the specified dry film thicknesses.
- F. Coverage and Continuity**
 1. Apply each coat to assure thorough wetting of the substrate or underlying coat, and to achieve a smooth, streamline surface relatively free of orange peel. Shadow-through, pinholes, bubbles, skips, misses, lap marks

between applications, or other visible discontinuities are not acceptable. Runs or sags may be brushed out while the material remains wet.

2. Thoroughly coat all surfaces with special attention to hard-to-reach areas.

G. Tint – Tint successive coats (if approved by the manufacturer), or use materials of sufficiently different color to facilitate proper coverage and to provide a visible distinction between coats.

H. Recoat Time – Apply each coat only after the previous coat has been allowed to dry as required by the manufacturer's written instructions, but as soon as possible to minimize the length of exposure to dust and contamination.

I. Coating Adhesion – Apply all coats in such a manner to assure that they are well-adherent to each other and to the substrate. If the application of any coat causes lifting of an underlying coat, or there is poor adhesion between coats or to the substrate, remove the coating in the affected area to adjacent sound, adherent, coating, and reapply the material.

J. Wet Film Thickness – Use wet film thickness gages to verify the thickness of each coat at the time of application in accordance with ASTM D4414.

K. Dry Film Thickness

1. Apply each coat to the thicknesses specified in Parts 2.03.B.7 through 12 of this Section.
2. Measure the thickness of each coat using non-destructive dry film thickness gages. Comply with SSPC-PA 2 and ASTM D7091 for the calibration and use of gages and frequency of thickness measurements.
3. If there are disputes regarding the coating thickness applied, a Tooke Gage (destructive scratch gage) may be used, but limit its use to a minimum of locations. Mark and repair all damage created by the destructive testing.
4. Apply additional coating to areas of insufficient thickness with care to assure that all repairs blend in with the surrounding material.
5. Unless directed otherwise by the Engineer, remove excessive coating thicknesses and reapply the affected coat(s).

L. Caulk/Sealant Application on Timber (Wood) Surfaces

1. Apply caulk/sealant to the entire length of all cracks and joints, crevices or gaps (refer to plan drawing 42 of 47 for width of cracks and joints, crevices or gaps to receive caulk/sealant) between timber members and

attached metal members. All caulking/sealant application shall be performed in accordance with the manufacturer's published instructions.

3.08 REPAIR OF DAMAGED COATING

- A. Damaged Coating** – Repair all damaged coating prior to project completion.
- B. Surface Preparation**
 - 1. Prepare localized damage by solvent cleaning in accordance with SSPC-SP 1 followed by power tool cleaning in accordance with SSPC-SP 3 with the exception that SSPC-SP2, Hand Tool Cleaning shall be used on any bridge cable requiring touch-up. Feather the surrounding coating at each repair for a distance of 1 to 2 inches to provide a smooth, tapered transition into intact coating. Roughen the existing coating to assure proper adhesion of the repair coat(s).
- C. Coating Application** – When the bare substrate is exposed in the damaged area, re-apply all coats of the coating system. When the damaged area does not extend to the bare substrate, re-apply only the affected coats. Maintain the thickness of the system in the overlap areas within the specified total thickness tolerances.

3.09 INSPECTION

- A.** The Division may inspect any or all phases of the Work to verify that it is in accordance with the requirements of this Specification. Facilitate this inspection as required, including allowing ample time for the inspections and access to the work. Inspections may include, but are not limited to, surface preparation, pre-painting cleanliness, paint application, dry film thickness, film appearance and continuity, and adhesion.
- B.** The presence or activity of Division inspections in no way relieves the Contractor of the responsibility to comply with all provisions of this Specification and to provide adequate inspections of its own.
- C.** Furnish, until final acceptance of the coating system, all equipment and instrumentation needed to inspect all phases of the work.

3.10 ONE-YEAR ANNIVERSARY INSPECTION

- A.** A one-year anniversary inspection will be conducted approximately twelve months after completion of the repainting work. Participate in this inspection with the Division.

- B. Repair, at no cost to the Division, all locations where the coating exhibits disbonding, cracking, rusting, or other defects. Perform all repairs in accordance with this Specification and the coating manufacturer's written instructions.
- C. The Contractor shall provide all equipment for all other aspects of the work necessary to complete the inspection, at no additional cost.

3.11 METHOD OF MEASUREMENT

- A. The unit of measurement for all work associated with “Section A, Surface Preparation and Repainting of the Wheeling Suspension Bridge” and “Section B, Technical Specification for the Removal of Lead Based Paint” shall be lump sum.

3.12 BASIS OF PAYMENT

- A. Basis of payment for “Section A, Surface Preparation and Repainting of the Wheeling Suspension Bridge” and “Section B, Technical Specification for the Removal of Lead Based Paint,” shall be lump sum price bid for the items listed in Part 3.13 of this Section, which price and payment shall be full compensation for furnishing all materials and all the work herein prescribed in an acceptable manner, including all labor, tools, equipment, supplies and incidentals necessary to complete the work.

3.13 PAY ITEMS

- A. **688002-001 CLEAN AND PAINT EXISTING BRIDGE COATED WITH LEAD BASE PAINT**
- B. **688003-001 CONTAINMENT AND DISPOSAL OF SPENT MATERIAL**

SECTION B

TECHNICAL SPECIFICATION FOR THE REMOVAL OF LEAD-BASED PAINT FROM THE WHEELING SUSPENSION BRIDGE IN WHEELING, WEST VIRGINIA

PART 1.0 –GENERAL

1.01 PURPOSE

- A.** This Specification provides the minimum requirements for protecting the public, Contractor workers, and the environment from exposure to lead and other toxic metals during abrasive blast cleaning, hand tool cleaning, pressure water cleaning, vapor blast cleaning and vacuum-shrouded power tool cleaning at the Wheeling Suspension Bridge over the Ohio River in Wheeling, West Virginia.
- B.** Paint will be removed from various surfaces of the bridge using a variety of surface preparation methods, including:
 - 1. hand tool cleaning of cables, hangar rods, and spot areas of the ornamental wrought iron railings, light posts, and I-beam arches,
 - 2. low pressure vapor blast cleaning of all wood surfaces (and the attached metal elements), and thin gage metals (i.e., cable housings, saddle access hatches, and tower caps),
 - 3. pressure water cleaning of the wrought iron railings, light posts, and I-beam arches,
 - 4. abrasive blast cleaning of the remote structural steel anchorages,
 - 5. and vacuum-shrouded power tool cleaning of spot areas of below deck framing steel, wrought iron railing, light posts, and I-beam arches.

Refer to Section A of the specification for specific details regarding surface preparation and coating application.

- C.** The Contractor is required to implement and maintain programs and procedures which comply with the requirements of this Specification and all applicable Federal, State, and local OSHA and EPA standards or regulations. The Contractor is cautioned that it must comply with all applicable regulations even if the regulation is not specifically referenced herein. If a State or local regulation is more restrictive than the requirements of this Specification, the more restrictive requirements prevail.

- D.** The existing coatings on the bridge contain lead, cadmium, total chromium, and hexavalent chromium. At project start up, conduct worker exposure monitoring during all methods of surface preparation for all metals that may be present in the paint or abrasive, and adjust all protection, training, medical surveillance, and recordkeeping provisions according to the results. Note that the results of any worker exposure monitoring undertaken by the Contractor have no bearing on the environmental protection and waste handling requirements of this Specification.
- E.** Identification of the items below which are of specific interest to the West Virginia Division of Highways (Division) in no way relieves the Contractor of the responsibility to comply with all EPA requirements, nor should it be construed that OSHA, EPA, or State and local regulators are only interested in these items.

1.02 REFERENCE STANDARDS

- A.** The latest edition of the following regulations, guides, and standards form a part of this Specification.
- B. Code of Federal Regulations (CFR)**

 - 1. 29 CFR 1926, Occupational Safety and Health Regulations for Construction
 - 2. 29 CFR 1926, Subpart L, Scaffolding
 - 3. 29 CFR 1926, Subpart M, Fall Protection
 - 4. 29 CFR 1926.51, Sanitation
 - 5. 29 CFR 1926.55, Gases, Vapors, Fumes, Dusts, and Mists
 - 6. 29 CFR 1926.57, Ventilation
 - 7. 29 CFR 1926.62, Lead
 - 8. 29 CFR 1926.103, Respiratory Protection
 - 9. 29 CFR 1926.1124, Beryllium
 - 10. 29 CFR 1926.1126, Hexavalent Chromium
 - 11. 29 CFR 1926.1127, Cadmium
 - 12. 40 CFR 261, Appendix II EPA, Toxicity Characteristic Leaching Procedure

13. 40 CFR 262, Standards Applicable to Generators of Hazardous Waste
14. 40 CFR 263, Standards Applicable to Transporters of Hazardous Waste
15. 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
16. 40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
17. 40 CFR 265, Subpart C, Preparedness and Prevention
18. 40 CFR 265, Subpart D, Contingency Plan and Emergency Procedures
19. 40 CFR 265.16, Personnel Training
20. 40 CFR 268, Land Disposal Restrictions
21. 40 CFR 302, Designation, Reportable Quantities and Notification
22. 40 CFR 355, Emergency Planning and Notification
23. 49 CFR 171-179, Hazardous Materials Regulations

C. EPA Methods

1. SW 846, Test Methods for Evaluating Solid Waste – Physical/Chemical Methods
2. Method 3050, Acid Digestion of Sediment, Sludge, and Soils
3. Method 1311, Toxicity Characteristic Leaching Procedure (TCLP)

D. NIOSH Methods

1. Method 7082, Lead
2. Method 7600, Hexavalent Chromium
3. Method 7300, Cadmium/Chromium

E. Society for Protective Coatings (SSPC)

1. Guide 6, Guide for Containing Debris Generated During Paint Removal Operations
2. Guide 7, Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
3. Guide TU-7, Conducting Ambient Air, Soil, and Water Sampling During Surface Preparation and Paint Disturbance Activities
4. SSPC 93-02, Industrial Lead Paint Removal Handbook, 2nd Edition, Volume I
5. SSPC 95-06, Project Design, Industrial Lead Paint Removal Handbook, Volume II

F. American Industrial Hygiene Association

1. Environmental Lead Laboratory Accreditation Program (ELLAP)
2. Industrial Hygiene Accredited Laboratory for Metals Analysis

1.03 SUBMITTALS

- A.** Submit all pre-construction submittals associated with this Section, as summarized in Appendix A (following this Section), to the Division for review and acceptance a minimum of 21 days prior to project start-up.

B. WVDOH Review of Submittals

Do not construe the Division's acceptance of Contractor submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of this Specification and all applicable regulations, or to adequately protect the health and safety of all workers involved in the project including any members of the public who may be affected by the project.

The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices and adherence to them.

PART 2.0 – PRODUCTS

2.01 CONTAINMENT MATERIALS

- A. Supply all materials needed to contain project debris in accordance with the provisions of Part 3.0 of this Specification. This includes ground covers, scaffolding, containment materials, dust collection and recycling equipment, HEPA vacuums, and tarpaulins. All containment materials and tarpaulins must be fire retardant.
- B. Use materials that are free of loose dust and debris when brought on site, and upon removal.

2.02 MONITORING AND TESTING EQUIPMENT

- A. Supply the instrumentation needed for the monitoring of worker exposures and waste sampling, as required in this Specification, including all equipment needed for its operation (e.g., generators, batteries, power cords, fuel, etc.).

2.03 PERSONAL PROTECTIVE EQUIPMENT AND HYGIENE FACILITIES

- A. Provide all personal protective equipment (PPE) and hygiene facilities needed for the project in accordance with the requirements of this Specification. Provide all necessary protective equipment and clothing for use by up to two Division representatives each day, including proper cleaning and disposal.
- B. Repair or replace PPE as required to assure that it continues to provide its intended purpose.
- C. Use PPE and hygiene facilities that are free of lead or other toxic materials when brought onto the site, and that are clean upon removal. Properly handle and dispose of all hygiene water, cleaning materials, and PPE that cannot be cleaned for reuse. Comply with this Specification for proper disposal.

2.04 WASTE CONTAINERS

- A. **Hazardous Waste** – Provide DOH-approved containers of the appropriate size and type for the hazardous paint waste generated on the project. Use containers that are resistant to rust and corrosion (painted, if constructed of steel), that have tight fitting lids or covers, and which are water resistant and leak proof.

- B. Municipal/Construction Waste** – Provide all containers for non-hazardous municipal/construction waste. Use fully enclosed, leak proof containers that are free of loose debris when brought on-site.
- C. Spent Solvents** – Provide fully enclosed, leak proof containers for spent solvents. Do not mix spent solvents with spent abrasives, paint debris, waste water, or other waste.
- D. Liquid** – Provide leak proof and fully enclosed containers for the storage of all waste water resulting from high pressure water cleaning and personal hygiene activities.
- E. Container Maintenance** – Maintain all containers in good operating condition with all lids and closing mechanisms intact and operational to prevent the escape of debris by wind, spilling of the contents, or access by unauthorized personnel.

PART 3.0 – EXECUTION

3.01 WORKER PROTECTION – Conduct the work in strict accordance with Federal, State, and local regulations governing worker protection. Institute engineering and work practice controls to reduce worker exposures to lead and other toxic metals to as low as feasible. All worker protection requirements apply to Contractor and Subcontractor personnel working for the Contractor.

- A. Lead (Toxic Metal) Health and Safety Compliance Program** – Develop and implement a worker protection compliance program, developed and signed by a Certified Industrial Hygienist (CIH), to protect Contractor personnel from exposure to toxic metals in the abrasives being used and the paint that will be disturbed during rehabilitation activities. The OSHA Lead in Construction Standard, 29 CFR 1926.62, is the basis for the requirements of this Specification, but make certain that the workers are protected from harmful exposures to all toxic metals in the paint. The CIH, or a technician working under the direction of the CIH, shall be present during the first three days of work and at least twice a month thereafter. The CIH shall certify in writing during the first week of work and at the end of the work that the worker protection compliance program was fully implemented.
- B. Worker Exposure Monitoring**
 - 1. Collect representative personal air samples at the beginning of each type of paint disturbance activity to determine worker exposures to lead and other toxic metals. These activities include, but are not limited to, abrasive blast cleaning, vapor blast cleaning,

hand and power tool cleaning, pressure water cleaning, containment movement, and waste handling.

2. Provide all exposed workers with the appropriate protective clothing, hygiene facilities, respiratory protection, medical surveillance, and training during the initial monitoring. Since lead is present, protect workers during the initial monitoring to the anticipated exposure levels as dictated by 29 CFR 1926.62 and as specified below. Use the same level of protection when other toxic metals are present in the coating, unless OSHA has developed a comprehensive health standard for that metal. In those cases, implement the protection requirements of the standard for that metal.
 - a) Assume an exposure of at least 50 $\mu\text{g}/\text{m}^3$: Manual demolition of structures containing lead-containing coatings or paint (e.g., dry wall), manual scraping, manual sanding, heat gun applications, power tool cleaning with dust collection systems, and spray painting with lead paint. Although not included in 29 CFR 1926.62, high pressure water cleaning and operation of abrasive grit recovery equipment are included in this category.
 - b) Assume an exposure of at least 500 $\mu\text{g}/\text{m}^3$: Using lead-containing mortar, lead burning, or conducting the following activities where lead-containing coatings or paint are present: rivet busting, power tool cleaning without dust collection systems, cleanup activities where dry expendable abrasives are used, and the movement and removal of abrasive blasting enclosures.
 - c) Assume an exposure of more than 2,500 $\mu\text{g}/\text{m}^3$: Abrasive blasting, welding, cutting, and torch burning of lead containing coatings or paint on structures.
 - d) During any of the above activities, provide appropriate respiratory protection, personal protective clothing and equipment, change areas and washing facilities, blood lead and zinc protoporphyrin monitoring, and employee training. Maintain the protection as specified above until the test results are received, then modify the protection measures as necessary.
3. Collect and analyze all air samples according to the appropriate NIOSH method, or equivalent, for the metal of concern (e.g., Method 7082 for lead).

4. Provide the Division with the results of all initial and subsequent monitoring within the same 5-day notification period required for the employee, and no later than 10 days after sampling.
5. If the results of representative monitoring indicate that exposures to toxic metals are below the OSHA Action Levels ($30 \mu\text{g}/\text{m}^3$ in the case of lead), specialized protective measures other than providing hand washing facilities may not be required. Additional monitoring is not necessary unless the conditions and operations that took place during the initial monitoring are no longer representative of the paint disturbance activities being performed.
6. If the results of the monitoring indicate that exposures to toxic metals are above the OSHA Action Level, but below the OSHA Permissible Exposure Limit (PEL - $50 \mu\text{g}/\text{m}^3$ in the case of lead), comply with the following paragraphs of 29 CFR 1926.62: Exposure Assessment, Housekeeping, Employee Medical Surveillance and Medical Removal Protection, Employee Information and Training, and Recordkeeping.
7. If the results of the monitoring indicate that exposures to toxic metals are above the OSHA PELs, comply with the following paragraphs of 29 CFR 1926.62 in addition to those presented in the preceding paragraph when the Action Level is exceeded: Respiratory Protection, Protective Work Clothing and Equipment, and Hygiene Facilities and Practices.
8. Ensure that all air samples are analyzed by laboratories accredited by the American Industrial Hygiene Association (AIHA) for metals analysis.

C. Respiratory Protection

1. After feasible engineering controls and work practices have been implemented, use respiratory protection as necessary to maintain employee exposures to lead and other toxic metals below the PEL. Require the use of respirators for all employees, inspectors, observers, or other personnel who enter areas where airborne exposures exceed or are expected to exceed the PEL, or when entering regulated areas.
2. Provide respiratory protection for up to two Division representatives per each shift, including fit tests. The Division is responsible for verifying that the representatives are medically fit to wear respirators.

3. Develop a written Respiratory Protection Program in compliance with 29 CFR 1926.103, including commitments to provide the necessary medical examinations. Since lead, cadmium and hexavalent chromium are present, include the provisions of 29 CFR 1926.62, 29 CFR 1926.1127 and 29 CFR 1926.1126 respectively. Address the selection, use, maintenance and inspection of respirators, and qualifications for respirator users.
4. Provide appropriate respirator cartridges for lead removal and paint application where air purifying respiratory protection is determined to be appropriate.
5. Treat used respirator cartridges as hazardous waste and dispose of in accordance with the waste management requirements of this Section.

D. Protective Clothing and Equipment

1. Provide protective clothing and equipment and ensure they are worn by all employees whose exposures exceed the PEL. Provide all required protective clothing and equipment for use by up to two Division representatives each shift.
2. Identify in the Lead (Toxic Metal) Health and Safety Compliance Program the type of protective clothing to be provided for each job classification and the schedule of cleaning and replacement.
3. Do not allow workers to wear street clothing beneath protective clothing in any areas where exposures to toxic metals exceed the PEL.
4. Clean or replace the protective clothing as required by the appropriate OSHA standard for the toxic metal that is present. In the case of lead, clean or replace the clothing weekly if the airborne exposure levels are less than $200 \mu\text{g}/\text{m}^3$ as an 8 hour TWA, or daily if the exposure levels are greater than or equal to $200 \mu\text{g}/\text{m}^3$. Do not use disposable clothing (e.g., Tyvek suits) for more than one day.
5. Do not remove or clean the clothing by any means that reintroduces the toxic metals into the ambient air (e.g., brushing, shaking, or blowing). Use HEPA vacuums for cleaning.
6. Store the used clothing in sealed containers.

- a) If the clothing is to be laundered and it has been exposed to lead, label the containers with the following:

CAUTION

**CLOTHING AND EQUIPMENT CONTAMINATED WITH LEAD
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK, OR SMOKE WHEN HANDLING
DO NOT REMOVE DUST BY BLOWING OR SHAKING
DISPOSE OF LEAD CONTAMINATED WASH WATER IN
ACCORDANCE WITH APPLICABLE LOCAL, STATE
OR FEDERAL REGULATIONS**

If the clothing has been exposed to cadmium, hexavalent chromium, or other metals, modify the above text accordingly.

- b) If the clothing is disposable, label the containers as clothing contaminated with lead and other toxic metals, if applicable. Apply hazardous waste labels as appropriate after testing.
7. If the clothing is washed on site, provide containers for the collection and retention of the water after filtration. Provide ample filtration (e.g. through a multi-stage filtration system ending in 5 microns or better if needed) until the water can be disposed of as non-hazardous. Conduct all required tests of the water, and comply with the waste management requirements of this Section for disposal.

E. Housekeeping

1. Clean accumulations of dust or debris containing lead or other toxic metals daily, at a minimum. Clean more frequently if visible accumulations are observed that could be carried outside of the regulated area by wind, worker's shoes, rainwater, or other means.
2. Conduct all cleaning with HEPA vacuums. Do not use compressed air for housekeeping purposes unless it is used in conjunction with a ventilation system capable of capturing the resulting airborne particulate.
3. Containerize the debris for proper disposal in accordance with the waste management requirements of this Section.

F. Personal Hygiene Facilities and Equipment

1. Provide clean lavatory and hand washing facilities in accordance with the OSHA sanitation standard, 29 CFR 1926.51. Locate the

hand washing facilities in close proximity to the paint removal operations, in an area that is convenient for washing prior to eating or smoking.

2. Provide showers when exposures exceed the PEL. Confirm that all employees whose exposures exceed the PEL shower prior to leaving the construction site. Provide the Division representatives with access to the lavatory and hand washing/shower facilities.
3. Prohibit eating, drinking, smoking, chewing of food or tobacco products, or the application of cosmetics in any area where the exposure to toxic metals exceeds the PELs or within regulated areas, and confirm that workers thoroughly wash hands and face prior to undertaking any of these activities.
4. Provide clean lunch and break areas for use by all employees, and maintain airborne concentrations in these areas below the Action Levels.
5. Provide clean change area(s) for employees whose exposures exceed the PELs. Equip the change area(s) with separate storage facilities for street clothing that are adequately segregated to prevent cross-contamination from work clothing. Assure that employees do not leave the construction site wearing any clothing that was worn while performing activities where exposures exceeded the PEL.

G. Medical Surveillance and Medical Removal Protection

1. Provide all employees with initial and periodic blood and zinc protoporphyrin sampling and analysis, and medical surveillance as required by the published OSHA health and safety standards for the metal of concern.
2. In the case of lead, at a minimum conduct blood sampling and analysis initially within two weeks prior to the start of the project, then once every two months for the first six months of exposure, and at six month intervals thereafter. Conduct exit blood tests for each worker upon completion of his/her work activities which involve exposure to lead, even if completion of the worker's activities which involve exposure to lead occurs prior to the completion of the Work of the Contract.
3. Do not use workers with initial blood lead concentrations of 40 micrograms per deciliter ($\mu\text{g/dl}$) or higher for any work activities involving exposure to airborne lead above the Action Level.

4. Provide intervention for any employee when the blood analysis indicates that unacceptable results are occurring (e.g., 40 µg/dl or above in the case of lead).
5. Provide for the temporary removal of employees from exposures above the Action Level for the metal of concern when the blood analysis indicates that unacceptable results are occurring (e.g., 50 µg/dl or above in the case of blood lead). Protect employees' benefits during any period of medical removal and conduct all tests required by the OSHA standard for the metal of concern during the removal period.
6. Provide all physical examinations as required by the appropriate OSHA standards for the metal(s) of concern, and verify that all examinations are performed by or under the direct supervision of a licensed physician.
7. Provide all exam information and test results to the employees in writing within 5 days of receipt. Maintain copies of all biological monitoring results on site within 10 days of sampling, and make results (excluding employee identification) available for Division review.

H. Employee Training and Information

1. Provide initial and annual refresher training for all employees who will be exposed to toxic metals above the respective Action Levels on any one day in a 12-month period. Include all of the elements of training that are required by the appropriate OSHA standard. If a standard for the metal does not exist, use the training requirements of 29 CFR 1926.62 as the basis of the training program highlighting the differences as appropriate for the other metals of concern. Maintain documentation of training on site for all workers, and make this training documentation available for Division review.
2. When other contractors or employers are present at the site, notify them of the nature of the lead exposure work, the need to remain out of exposure areas, the warning signs and labeling system in effect, and the potential need for them to take measures to protect their employees in accordance with the applicable OSHA regulations.

I. Regulated

Areas

1. Establish physically demarcated regulated area(s) around the work areas involving the disturbance of paint, and in the waste storage areas to prevent entry into the areas by untrained and unprotected

personnel.

2. Post signs at the entrance of the regulated area(s) with the following legend:

DANGER

LEAD MAY DAMAGE FERTILITY OR THE UNBORN CHILD

CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM

DO NOT EAT, DRINK OR SMOKE IN THIS AREA

3. In the submittals, describe the methods that will be used for establishing the locations for the regulated areas, and the identification system that will be used (e.g., ribbons and signs).

3.02 CONTAINMENT

A. General

1. Use an SSPC Class 1A containment system for all work involving surface preparation by abrasive blasting. For all work involving hand tool cleaning or vacuum-shrouded power tool cleaning, erect and use an SSPC Class 3P containment system. For pressure water cleaning and vapor blast cleaning, use an SSPC Class 2W containment system. The 2W containment system must be designed and maintained to capture and collect all paint chips and debris, as well as wash water for proper disposal.
2. Construct and utilize the containment systems in accordance with SSPC Guide 6 and the attached Table 1, "Containment Criteria for Removal of Paint Containing Lead and Other Toxic Metals" following Appendix A.
3. Prior to dismantling or moving each Class 1A containment system, remove spent abrasive and dust to the extent that it will not be dislodged during handling. Cleaning may be accomplished by blowing down all surfaces with the ventilation system in operation, and/or by HEPA vacuuming.
4. Allowable Containment Lengths: Only one containment system at each tower may be erected at one time and that containment system may not be longer than 50 linear feet horizontally in either direction for the first 200 feet. After the first 200 feet, the containment system may not be longer than 100 linear feet.
5. Containment tarps or drapes shall be removed, dropped or dismantled if wind speeds exceed 40 mph.

B. Scaffolding

1. Strictly follow all applicable OSHA regulations regarding the installation and daily inspection of scaffolding, platforms, and wire cables. Verify that the platform and its components are designed and constructed to support at least 4 times its maximum intended load without failure, with wire cables capable of supporting at least 6 times their maximum intended load without failure. Strictly follow all applicable OSHA regulations regarding scaffolding.

C. Containment Components – The basic components that make up containment systems are defined below. The components are combined in Table 1 to establish the minimum containment system requirements for the method(s) of paint removal specified for the Contract.

1. **Rigidity of Containment Materials** – Rigid containment materials consist of solid panels of plywood, aluminum, rigid metal, plastic, fiberglass, composites, or similar materials. Flexible materials consist of screens, tarps, drapes, plastic sheeting, or similar materials.
2. **Permeability of Containment Materials** – The containment materials are identified as air impenetrable if they are impervious to dust or wind such as provided by rigid panels, coated solid tarps, or plastic sheeting. Water impermeable materials are those that are capable of containing and controlling water when wet methods of preparation are used. Use fire retardant materials in all cases.
3. **Support Structure** – Rigid support structures consist of scaffolding and framing to which the containment materials are affixed to minimize movement of the containment cocoon. Flexible support structures are comprised of cables, chains, or similar systems to which the containment materials are affixed.
4. **Containment Joints** – Fully sealed joints require that mating surfaces between the containment materials and the structure being prepared are completely sealed. Sealing measures include tape, caulk, Velcro, clamps, or other similar material capable of forming a continuous, impenetrable or impermeable seal. All seams shall be overlapped a minimum of 6 inches and fastened together at 12 inch intervals at a minimum.
5. **Entryway** – Re-sealable door entryways involve the use of flexible or rigid doors capable of being repeatedly opened and resealed. Sealing methods include the use of zippers, Velcro, clamps, or

similar fasteners. Overlapping door tarpaulin entryways consist of two or three overlapping door tarpaulins. Open seam entryways involve entrance into the containment through any open seam.

6. **Mechanical Ventilation** – The requirement for mechanical ventilation is to ensure that adequate air movement is achieved to reduce worker exposure to toxic metals to as low as feasible in accordance with OSHA regulations (e.g., 29 CFR 1926.62), and to enhance visibility. Design the system with proper exhaust ports or plenums, adequately sized ductwork, adequately sized discharge fans and air cleaning devices (dust collectors) and properly sized and distributed make-up air points. Natural ventilation does not require the use of mechanical equipment for moving dust and debris through the work area. It relies on natural airflow patterns, if any, through the containment. For all Class 1A containment systems, design the system to meet the minimum airflow velocities of 100 feet per minute cross-draft or 60 feet per minute down-draft.
7. **Negative Pressure** – When specified, achieve a minimum of 0.03 inches (7.5 mm) water column (W.C.) relative to ambient conditions, or confirm through visual assessments for the concave appearance of the containment enclosure.
8. **Exhaust Ventilation** – When mechanical ventilation systems are used, provide filtration of the exhaust air, otherwise airborne particulate from the containment will be exhausted directly into the surrounding air. Utilize a filter that is at least 99.9% efficient in removing mono-dispersed particles of 0.5 micrometers in diameter.

2.05 D. Protection of Drainage Systems and Utilities

1. Protect storm sewers and drains from the entrance of debris from the performance of the Work. Keep all drain protection systems clean and operational throughout the duration of the Contract. Remove all visible debris from the drain protection systems or from areas where rainwater could carry the debris into drains or storm sewers, at the end of each workday at a minimum.

3.03 ENVIRONMENTAL PROTECTION

A. General – Conduct daily visual assessments of visible emissions and releases of spent abrasive or wash water to the air, water, and sediment. Undertake all necessary corrective action to control emissions and clean up the work site during and after the project, including the removal of pre-existing litter, paint chips, or debris.

B. Assessment and Correction of Visible Emissions

1. Conduct visible emissions assessments as defined in this Section and in accordance with 40 CFR 60, Appendix A, Method 22. This assessment is based on total visible emissions regardless of the opacity of the emission. Method PD/Lead A4 of SSPC publication 95-06, Project Design, provides guidance on visible emissions assessments.
2. Conduct the visible emissions assessments to account for all locations where emissions of lead dust might be generated, including but not limited to, the containment or work area, dust collection and waste recovery equipment as applicable, and waste containerizing areas.
3. In addition to assessing airborne emissions, conduct visual inspections for releases or spills of dust and debris that have become deposited on surrounding property, structures, equipment or vehicles, and bodies of water.
4. Include procedures in the Environmental Compliance Plan for the assessment of visible emissions and releases, the frequency of observations and inspections that will be made, the equipment and work areas (e.g., containment) that will be observed for visible emissions, and the surrounding property and structures that will be examined for deposited debris, and the corrective action that will be taken should emissions occur. Include a copy of the form that will be completed to document visible emission observations.

C. Acceptance Criteria for Visible Emissions Assessments

1. Random visible emissions from project activities are restricted to an SSPC Level 1 random airborne emissions of a cumulative duration of no more than 1 percent of the workday. This amounts to a maximum duration of 4 minutes and 48 seconds in an 8-hour workday, or 36 seconds per hour.
2. Visible emissions in excess of the above Level 1 criteria are cause for immediate shutdown.
3. Immediately stop the applicable operations if these criteria are violated. Correct and repair the deficiencies causing the emission, and undertake clean up with HEPA vacuums.

D. Frequency and Location of Emissions Assessments

1. Conduct the specialized assessments as described in this Section at least four times (for a minimum of fifteen minutes each) during each shift in which abrasive blast cleaning or brush-off blasting operations are underway. Document all observations even if visible emissions are not observed. Visible emission assessments are not necessary during high pressure water cleaning, brush-off blast cleaning using vapor blast equipment, vacuum-shrouded power tool cleaning, or hand tool cleaning activities.
2. Perform casual observations of emissions on an ongoing basis.

E. Assessment and Correction of Spills or Releases

1. Conduct all activities so that spills or releases of paint chips, spent abrasive, wash water, dust or debris do not occur.
2. On a daily basis, visually inspect the site for releases of dust, paint chips, wash water and debris outside of the work area that have become deposited on surrounding property, structures, equipment, or vehicles; on the unprotected ground or in areas where rain water could carry the debris outside of the work area.
3. Clean up all visible paint chips and debris on a daily basis at the end of each shift, or more frequently if directed by the Division. Conduct the cleaning by manually removing paint chips or by HEPA vacuuming.
4. When releases are observed, in addition to cleaning the debris, change work practices, extend the ground coverings, modify the containment, or take other appropriate corrective action to prevent similar releases from occurring in the future. Do not resume operations until the corrective measures have been inspected and approved by the Division.
5. Water booms shall be used to contain inadvertent releases of debris unless prohibited by navigation lanes. In these cases, a boat with a skimmer shall be used to collect fugitive materials. Remove all project-related debris from the surface of the water at the end of each day unless otherwise directed by the Engineer.

F. Reporting of Visible Emissions and Releases

1. Document all visible emission observations and all cases where work has been halted due to unacceptable visible emissions or

releases, the cleanup activities invoked, and the corrective action taken to avoid reoccurrence. Provide a report to the Division within 48 hours of the occurrence.

2. Maintain the results of the assessments in a log at the site. Identify the frequency of observations made, the methods of observation utilized, the name of the observer(s), and documentation completed. Include and summarize the documentation prepared for work stoppages due to unacceptable visible emissions or releases. Make the log available to the Division for review upon request.

3.04 WASTE CLASSIFICATION, HANDLING, AND DISPOSAL

A. General

1. The Division is the generator of the hazardous waste for permitting purposes, and will provide the EPA identification number and signatures on waste manifests. and proper transportation and disposal of all wastes, but the Contractor is responsible for the collection, handling, storage, transportation and disposal of all waste generated on the project.
2. Recover all waste products generated during demolition activities, including but not limited to rags, tape, disposable coveralls, filters, and paint debris.
3. Select the location of the secured waste storage area together with the Division. Store the waste in an area outside the 100-year flood plain. Transport the waste to the secured storage area at the end of each day.
4. Conduct the work in strict accordance with Federal, State, and local regulations governing the handling, transportation and disposal of waste.

B. Items Provided by the Division

1. An EPA ID number.
2. Signatures on the hazardous waste manifest.

C. Items Provided by the Contractor

1. Containerizing, testing (classifying), handling, and storage of all waste.
2. Contracting with licensed and permitted transporters and disposers of all waste.
3. Secure waste storage areas, selected with the approval of the Division.

D. Paint Waste Sampling, Testing, and Classification

1. General
 - a) Comply with the following provisions for the sampling, testing, and classification of any paint waste generated from the project, such as spent abrasive, or paint chips resulting from vacuum-shrouded power tool cleaning operations.
2. Sampling of Paint Debris
 - a) Collect a minimum of four representative samples of each waste stream generated by project activities. Collect all samples under the observation of the Division.
 - b) Collect samples in accordance with SW-846, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods." Describe the sampling methods in the Waste Handling Plan.
 - c) Complete the initial sampling of each waste stream immediately upon filling the first container, but do not allow waste to accumulate for longer than 30 days before sampling. After the representative samples are collected, send them immediately to the laboratory for analysis.
 - d) Unless otherwise directed by the Division, or required by State regulations or the waste recycling or disposal facility, once each waste stream is sampled, tested, and classified, additional sampling and analysis are not required for subsequent shipments unless the waste stream changes.
3. Testing of Paint Debris
 - a) Have all testing performed by a qualified laboratory acceptable to the Division. Direct the laboratory to test the

waste in accordance with 40 CFR 261, Appendix II, Method 1311 Toxicity Characteristic Leaching Procedure (TCLP), to determine if it is hazardous.

- b) Analyze the first sample from each waste stream by TCLP for all eight RCRA metals and other hazardous substances. If the first sample from the waste stream tests hazardous, the waste can be declared as hazardous without testing the remaining three samples. If the first sample tests non-hazardous, the remaining samples must be tested before declaring the waste non-hazardous. When the remaining three samples are analyzed, test for all metals or hazardous materials that were detected in the initial TCLP testing.
- c) When recyclable steel abrasives are used, treat the resultant waste stream as hazardous.

4. Classification of Paint Debris

- a) Paint debris is classified as hazardous waste if the leachate contains any of the eight RCRA metals or other hazardous substances in concentrations at or above limits established in 40 CFR 261. Note that waste resulting from the use of recycled steel abrasives must be classified as hazardous, regardless of test results. The limits established in 40 CFR 261 are as follows:

Arsenic -	5.0	mg/L
Barium -	100.0	mg/L
Cadmium -	1.0	mg/L
Chromium -	5.0	mg/L
Lead -	5.0	mg/L
Mercury -	0.2	mg/L
Selenium -	1.0	mg/L
Silver -	5.0 mg/L	

- b) The above includes only those elements typically associated with paints. Other substances may be present which may cause debris to be classified as hazardous waste as defined in 40 CFR 261 (e.g., $\text{pH} \leq 2.0$ or ≥ 12.5 resulting in corrosivity, or the characteristic of ignitability) and must be taken into account.

5. Laboratory Report – Analysis of Paint Debris

- a) Provide the Division with copies of the test results as soon as they are received from the laboratory, and no later than ten days after the representative samples are collected.
- b) Include the following minimum information in each report: identity of the waste stream(s) analyzed, the number of samples collected and tested, dates of sampling and testing, laboratory test procedures utilized, and the names and signatures of the individuals collecting the samples and conducting the laboratory tests, and an interpretation of the results. Include copies of the chain-of-custody forms in the documentation.

E. Handling, Packaging, and Storage of Waste

- 1. Comply with 40 CFR 262 and State and County regulations for the on-site handling, packaging, and storage of all hazardous waste generated by the project.
- 2. Comply with State and County regulations as applicable for the handling, packaging, and storage of non-hazardous construction waste.
- 3. Do not place hazardous waste on the unprotected ground (e.g., cover the ground with impervious tarpaulins). Locate hazardous waste in a secure area, outside the flood plain, with signs around the perimeter, and shielded adequately to prevent dispersion of the waste by wind or water. Contact the Division for approval of the storage location(s). If the Division identifies a separate location at the project site as the secure storage area, when the quantity of waste at the satellite storage area exceeds 55 gallons, move the debris to the designated storage area within three days.
- 4. At a minimum, collect and store the waste at the end of each working day in storage drums or containers such that no waste is left exposed overnight. Use DOH-approved containers for hazardous waste storage.
- 5. Cover all containers immediately upon filling and confirm that all lids are attached except when filling. Verify that all labels remain intact.
- 6. Store non-hazardous waste separately from hazardous waste. Do not co-mix hazardous waste with non-hazardous waste. Do not mix different types of hazardous waste together unless specifically approved by the disposal facility.

7. Arrange containers in the storage area for easy accessibility. Stage the containers together in lots no greater than two rows of five containers each. Maintain a minimum lane clearance of 36 inches between each lot of ten containers.
8. Verify that all waste is transported to the appropriate recycling or disposal facility within 60 days after waste is first placed into the container.
9. Improper waste storage is cause for immediate project shut down until appropriate corrective action is completed.
10. Train all personnel in the proper handling of the hazardous waste at the work site in accordance with 40 CFR 265.16. Include procedures in the Waste Handling Plan that will be followed in the event of a release or spill, required notifications, and methods to be used for cleanup. Maintain all training records on-site.
11. Do not fill any container or roll-off in excess of the capacity marked on the container. If delays during pick-up are caused by overfilled containers, remediate the situation at no additional cost to the Division.

F. Labeling of Waste Containers

1. Immediately label all containers of project waste and debris to identify the contents.
2. After the TCLP test results are received, immediately apply hazardous waste labels, if the waste tests hazardous. Label each container or roll-off of hazardous waste in accordance with 40 CFR 262, 49 CFR 171-179, and State and County regulations. Include the following minimum information:
 - a) Hazardous Waste. Federal law prohibits improper disposal. If found, contact the nearest police, or public safety authority, or the U.S. Environmental Protection Agency.
 - b) Proper DOT Shipping Name
 - c) Manifest Document Number
 - d) Generator Name, Address, and EPA ID Number

- e) Date of Accumulation
 - f) EPA Waste Number
3. Apply non-hazardous waste classification labels on all other project waste in accordance with County and State regulations.
 4. Enter the above information using permanent marking material, printed in English, and displayed on a background of contrasting color unobscured by other labels or attachments. Locate labeling away from other markings that could substantially reduce its effectiveness.
 5. Complete the labeling, marking, and placarding activities under the observation of the Division, prior to storing or transporting any container or roll-off.

G. Special Waste Requirements for Recycled Steel Abrasives

1. If recycled steel abrasives are used, collect, handle, and store the waste in the same manner as if it tested hazardous.
2. Immediately label containers of waste and debris resulting from the use of recycled steel grit as hazardous in accordance with the requirements of this Section.

H. Special Handling and Disposal Conditions for Waste Water

1. Provide containers for the collection and retention of all waste water, including but not limited to the high pressure water cleaning water, water resulting from the use of vapor blast equipment, the water used for hygiene purposes, laundering of clothing if done on site, and cleanup activities.
2. Filter visible paint chips and particulate from the water prior to placing it into the containers. Prior to disposal, test the water for total toxic metals (and any other analytical parameters required by the disposal facility) and provide ample filtration (e.g., through a multi-stage filtration system ending in 5 microns or better if needed) until the water is classified as non-hazardous.

- I. Recordkeeping** – Provide the following information to the Division for a retention period of a minimum of 5 years: all manifests, a listing of the type and quantity of all waste generated, and the transportation and disposal facilities used for all waste.

3.05 CLEANING AND CLEARANCE OF MATERIALS, EQUIPMENT, AND SURROUNDING SURFACES

A. Contractor Materials and Equipment

1. Upon completion of project activities, remove all Contractor equipment and materials. Thoroughly HEPA vacuum, wash, or otherwise decontaminate reusable items until they are visually clean prior to removal from the project site. The use of compressed air for cleanup activities is prohibited unless used in conjunction with a ventilation system designed to capture the airborne particulate. The items to be cleaned include, but are not limited to, demolition equipment, paint removal equipment, containment materials, ground covers, and scaffolding.
2. If adequate cleaning is not possible, treat materials as waste and dispose of in accordance with the requirements of this Specification.
3. Collect water used for cleaning and dispose of in accordance with the requirements of this Specification.

B. Cleaning of Surrounding Property and Surfaces

1. General Inspection and Cleaning Requirements
 - a) Upon completion of project activities, and after all Contractor equipment and materials have been removed, conduct an inspection of the project site and surrounding property and surfaces located within the likely dispersion zone of project dust and debris.
 - b) Thoroughly inspect the property and surfaces for the presence of project-generated debris including, but not limited to, spent paint removal media, paint chips, materials of construction, fuel, and other litter. Remove all visible paint chips and debris from the project site, even if the paint chips and debris were a pre-existing condition. Use HEPA vacuums as needed for the cleaning.
 - c) After all clean up activities are completed, conduct a final inspection with the Division. Conduct any additional cleaning identified by the Division.
 - d) Include procedures for project clean up in the Environmental Compliance Plan.

- e) Collect water used for cleaning and dispose of in accordance with the requirements of this Specification.
- C. **Report on Clearance Inspections** – Prepare a letter report presenting the results of the inspections and tests conducted to verify the final cleanliness of the project site, surrounding property, waterways, and equipment. Include a summary of any problems or releases that occurred during the project, and the clean up and corrective action measures that were taken to resolve the problem and to prevent reoccurrence.

3.06 REPORTABLE RELEASES

- A. **CERCLA** – Reportable quantities under CERCLA are found in 40 CFR 302. In the case of lead, the reportable quantity is a release of 10 or more pounds in a 24-hour period. If such releases occur, stop work immediately and notify the WVDOPH and the National Response Center (800.424.8802).

APPENDIX A SUBMITTALS

A0.1. GENERAL – Provide all submittals of this Appendix to the Division.

A0.2. PRE-CONSTRUCTION – Provide the following submittals a minimum of 21 days prior to the start of any activities which result in the disturbance of the coatings:

- A. **Qualifications, Experience, and Certifications** – Provide written qualification, experience, and certification information for the following:
 - 1. Laboratory Qualifications, Experience, and Certifications
 - a) Provide the name, address, telephone number, and contact person of the laboratory that will be used for the blood lead analysis. Confirm that the laboratory conducting the worker blood lead analysis is participating in the United States Centers for Disease Control and Prevention blood lead laboratory proficiency program.
 - b) Provide the name, address, telephone number, and contact person of the laboratory(s) that will be used for the analysis of worker exposure, TCLP, and wastewater samples.
 - c) Provide evidence that the analytical laboratory proposed for worker exposure, TCLP testing, and waste water sample

analysis is American Industrial Hygiene Association (AIHA) accredited for metals analysis.

2. Competent Person – Provide the name, experience, training, and qualifications of the proposed Competent Person(s) for the project. The listing of multiple Competent Persons is strongly encouraged. Confirm that each Competent Person has received a certificate of completion for the SSPC C-3 course, or comparable course acceptable to the Division and have received the 8-hour C-5 refresher training within the past year.
3. Transporter/Disposer Qualifications, Experience, and Permits
 - a) Provide the names, addresses, qualifications, permit numbers, and contact person for the proposed transporter(s) of hazardous waste, non-hazardous waste, and wastewater.
 - b) Provide the name, address, telephone number and contact person for each waste disposal facility proposed for use in the Contract, including but not limited to: hazardous, non-hazardous, and wastewater. Provide evidence that each disposal facility has current registrations and permits for the operation of such facilities, or written approval from the State (and by the US EPA or other local agency, if applicable) in which it operates.
 - c) If the Contractor proposes to discharge wastewater directly into the sewer system after filtering, provide a permit or written documentation from the authority that provides approval of such activities prior to any discharges.
 - d) Advise each legally permitted waste disposal facility that the paint debris and waste will contain toxic metals, and identify the toxic metals that the waste will likely contain.
 - (1) Based on the above information, provide a letter from the proposed hazardous waste disposal facility, stating that the facility can accept this type of waste, is authorized to accept the waste under the laws of the State of residence, has the required capability to treat and dispose of the materials, and will provide or assure the ultimate disposal method indicated on the Uniform Hazardous Waste Manifest.

- (2) If more than one hazardous waste disposal facility will be utilized, provide a letter from each facility.
 - (3) Provide a letter from the proposed wastewater disposal facility, indicating that the facility has the capability to handle and properly dispose of the water. The letter shall also include the allowable concentration of lead in waste water that the facility is able to accept.
 - (4) Provide the Division with the original letters signed by a legally authorized representative of each facility.
4. The contractor shall have SSPC QP-1 and QP-2 certification in effect at time of bidding and throughout the entire project.

B. Containment Plans and Drawings – Provide a written description, shop drawings, and calculations for the design and construction of work platforms, and containment and ventilation systems, including, but not limited to the following:

1. Provide detailed drawings signed and stamped by Professional Engineer(s) licensed in the State of West Virginia.
2. Data, calculations, and assumptions used for the design of the Class 1A containment and ventilation system and for each Class 2W containment system, structural impact analysis, and the imposed loads (including wind loads) on the existing structure, signed by a Professional Engineer(s) licensed in the State of West Virginia. Include the design airflow within containment, and the locations and sizes of air inlets and exhaust for each Class 1A containment system.
3. The plan for staging, installing, moving, and removing each type of containment system, and the methods of attachment that will be used. Make attachment points to specific, substantial framing members only.
5. Provide a written plan describing the rigging and staging for this project. Have the plan signed by a Professional Engineer(s) licensed in the State of West Virginia verifying the bridge's ability to support all loads imposed by the Contractors operations, including but not limited to, the containment, rigging, temporary access and materials storage.

6. Include the methods of access that will be provided to work areas both inside and outside the containment, locations of safety lines, and locations of containment entryways. Provide a description of how each containment will be accessed (i.e., ladders) and identify the fall protection to be utilized within the containment.
7. The methods and procedures that will be used for cleaning the containment at the end of each work day, and the cleaning undertaken prior to dropping or relocating the containment.
8. Technical data sheets, specification sheets, any other information needed to thoroughly describe the containment plan and materials proposed for use. Provide the manufacturer's specifications for the proposed enclosure material(s), including information on light transmittance, flame spread, and fuel contributed, burst strength, abrasion durability, and unit weight of material.
9. A description of debris collection and air filtration equipment, including the equipment data sheets, airflow capacity, equipment weights and temporary utility service requirements.

C. Lead (Toxic Metal) Health and Safety Compliance Program – Submit the following information addressing worker health and safety from exposure to lead and other toxic metals.

1. Provide a written, project-specific Compliance Program prepared under the direction of and signed by a CIH, to establish and implement practices and procedures for protecting the health of those employees exposed to lead and other toxic metals contained in the paint or abrasive. Identify the methods of compliance that will be used to reduce worker exposures to toxic metals. Rely on respiratory protection only after feasible engineering and work practice controls have been first implemented to reduce airborne exposures. As part of the compliance plan, provide a site plot plan identifying all staging areas, location of hand wash and decontamination facilities, eating areas, regulated areas, and material and waste storage areas.
4. Include the name of the Competent Person(s) who will be making daily inspections of project activities to ensure compliance with the program.
5. Include the name of the CIH and documentation of his/her qualifications and experience, including documentation of his/her current board certification by the American Board of Industrial Hygienists.

6. Outside Laundry – Provide the name, address, and qualifications of the launderer, if one will be used, for the cleaning of reusable clothing. Provide a letter from the laundry indicating that it is permitted to handle clothing contaminated with lead and/or the other toxic metals of concern.
7. Personal Protective Equipment for Division Use – Acknowledge that all protective clothing and equipment, laundering or disposal, fit testing as needed, and hygiene facilities will be provided for up to two Division representatives per shift, if requested.
8. Identify the types of respiratory protection and protective clothing that will be provided for each job classification, and the schedule of cleaning and replacement. Include a Respiratory Protection Program as described in section 3.01.C.

D. Environmental Compliance Plan – Submit an Environmental Compliance Plan that establishes programs for the monitoring activities that will be undertaken under the Contract:

1. Assessments of Visible Emissions and Releases – A written program for the observation of visible emissions during the performance of the Work, and inspections for releases or spills of dust and debris that become deposited on surrounding equipment, property, and soil. Include the frequency and methods of observation and inspection that will be made, areas or work activities that will be observed, and the frequency and nature of clean up that will be undertaken. Include the name(s) of the personnel who will be conducting the observations and inspections. Include a copy of the form that will be utilized to document observations.
2. Final Cleaning/Clearance Evaluations – A written description of the procedures and methods that will be used to conduct final clean up and final visual cleanliness inspections and evaluations.

E. Waste Management Plan – Provide a written program that addresses the proper handling of all waste, including but not limited to, removed paint, abrasive, and paint chips.

1. Include the procedures that will be followed for collecting representative samples of the paint waste for testing; the testing and analytical procedures that will be used; the procedures for the site handling, storage, and packaging of all waste; and the

contingency plans that will be implemented in the event of a spill.

2. Include procedures that will be followed to assure that all reusable items such as equipment, ground covering materials, and scaffolding are cleaned of loose dust and debris prior to removal from the site.
3. Include the procedures and equipment that will be used for:
 - a) The proper collection and handling of abrasive, paint, waste water, and other debris, and its transportation to the storage area;
 - b) The collection of representative samples of the waste for testing;
 - c) The testing and analysis procedures that will be used and means used to classify solvent and paint wastes;
 - d) The site handling, storage, packaging, and labeling of the waste; and
 - e) Contingency Plan: Include an Executive Summary in the contingency plan according to the requirements of 40 CFR 262, and the summary should be readily available at the project site. At a minimum, the Summary is to include the types of hazardous and non-hazardous waste expected to be generated at the site and the associated hazards, an estimate of the amount of hazardous and non-hazardous waste generated, a description of the waste accumulation location, a map or description of the access/evacuation routes in case of a spill of hazardous waste or emergency, and the name and contact information of the emergency coordinator.

2. A0.3. CONSTRUCTION PHASE

- A. **Pre-Start Up Documentation** – Prior to commencing any activities that disturb the coatings, verify that the following items are on site and available for review by the Division:
 1. Documentation of initial biological monitoring for all personnel who may be exposed to lead.
 2. Documentation of training for lead and other toxic metals in accordance with 29 CFR 1926.62 or applicable regulation.

3. Documentation of respirator fit testing for personnel using respiratory protection.
4. Documentation of medical clearance for respirator use for personnel using respiratory protection.
5. Copy of the accepted Lead (Toxic Metal) Health and Safety Compliance Program, Environmental Compliance Plan, and Waste Management Plan.
6. Copy of the accepted containment plan.
7. Operational hand wash and decontamination facility.

B. Medical Surveillance Summary – Provide the Division with a summary of employee medical surveillance results that are indicative of worker exposures to (or which demonstrate proper protection from) toxic metals. In the case of lead, summarize the blood lead and ZPP results. Provide copies on site for review by the Division within 10 days of testing.

C. Air Monitoring Results – Report all worker exposure air monitoring results to the Division within 10 days of sampling.

D. Visible Emissions and Releases

1. Maintain and make available for the Division's review a log for the documentation of daily inspections and the documentation of unusual incidents or releases.
2. Provide the Division with an immediate verbal report each time that Work has been halted due to unacceptable visible emissions or releases.

E. Waste Management

1. Maintain and make available for the Division's review, a log of hazardous waste storage.
2. Provide a complete analytical package of TCLP test results of waste samples no later than 14 calendar days after sample collection and no later than 30 days after project start up. Include the following documentation, at a minimum:
 - a) Identity of the waste stream(s) analyzed.
 - b) The number of samples collected and tested.

- c) Dates of sampling and testing.
- d) Laboratory test procedures utilized.
- e) The names and signatures of the individuals collecting the waste samples and conducting the laboratory tests.
- f) An interpretation of the test results.
- g) Applicable signed chain of custody forms.

F. Project Clean Up

1. Provide the Division with a final letter report documenting that a final clearance inspection has been conducted. Include a summary of any clean up and corrective action measures that were needed.
2. Provide the letter within one week of demobilization.

TABLE 1
Containment Criteria for Removal of Paint Containing Lead and Other Toxic Metals¹

<u>Removal Method</u>	<u>SSPC Class²</u>	<u>Containment Material Flexibility</u>	<u>Containment Material Permeability³</u>	<u>Containment Support Structure</u>	<u>Containment Material Joints</u>	<u>Containment Entryway</u>	<u>Exhaust System Required</u>	<u>Negative Pressure Required</u>	<u>Air Filtration Required</u>
Abrasive Blast Cleaning	1A	Rigid or Flexible	Air Impenetrable	Rigid or Flexible	Fully Sealed	Airlock or Resealable	Mechanical	Yes	Yes
Hand Tool Cleaning and Power Tool Cleaning w/Vacuum ⁴	3P	Rigid or Flexible	Air Penetrable	Minimal	Partially Sealed	Open Seam	Natural	NA	NA
Vapor Blast Cleaning	2W	Rigid or Flexible	Water impermeable	Rigid or flexible	Fully Sealed	Overlap	Natural	NA	NA
Pressure Water Cleaning	2W	Rigid or Flexible	Water Impermeable	Rigid or Flexible	Fully Sealed	Overlap	Natural	NA	NA

¹This table provides general design criteria only. It does not guarantee that specific controls over emissions will occur because unique site conditions must be considered in the design. Other combinations of materials may provide controls over emissions equivalent to or greater than those combinations shown above.

²The SSPC Classification is based on SSPC Guide 6, "Guide for Containing Debris Generated During Lead Paint Removal Operation."

³Permeability addresses water and air as appropriate. Ground covers should always be impermeable, and of sufficient strength to withstand the impact and weight of the debris and the equipment used for collection and clean up.

⁴Ground covers and/or free hanging tarpaulins may provide suitable controls over emissions without the need to completely enclose the work area.

Appendix 1

Wheeling Suspension Bridge - Coating System Summary Table

This table provides a reference to the Parts of this Specification where detailed surface preparation and coating information can be found. The “Comments” column provides a brief summary of the primary method(s) of surface preparation to be used. In the event of conflict, the Specification Sections take precedence.

Bridge Surface	Surface Preparation	Coating System	Comments
<u>Bridge Cables & Hanger Rods</u> <ul style="list-style-type: none"> Hanger Rods Stay Cables Lateral Sway Cables Suspension Cables within Wire Wrapping (Spans 1, 2, & 3) 	Section A, Part 3.05.A <ul style="list-style-type: none"> SSPC-SP 2, Hand Tool Cleaning 	Section A, Part 2.03.B.7 & B.8 <u>Coating System 1A (Existing Cables)</u> 1 st Ct: HB Elastomeric Acrylic 2 nd Ct: Acrylic <u>Coating System 1B (New Cables)</u> Prime: Acrylic 1 st Ct: HB Elastomeric Acrylic 2 nd Ct: Acrylic	Clean 100% of surfaces to remove all loose rust, paint and other debris.
<u>Thin Gage Metals</u> <ul style="list-style-type: none"> Suspension Cables within Banded Metal Housings (Span 1, 2, & 3) Tower Caps incl. Saddle Access Hatches and Decorative Globes 	Section A, Part 3.05.B <ul style="list-style-type: none"> Specialized Low Pressure Vapor Blast Cleaning 	Section A, Part 2.03.B.9 <u>Coating System 2</u> 1 st Ct: Acrylic 2 nd Ct: Acrylic	Clean 100% of surfaces to remove all coating and superficially roughen surface. Use caution to not warp, distend, distort, or damage thin gage metal substrate.
<u>Ornamental Bridge Surfaces</u> <ul style="list-style-type: none"> Wrought Iron Railings in Span 1 I-Beam Arches in Spans 1 & 3 at Base of Towers 	Section A, 3.05.C <ul style="list-style-type: none"> Pressure Water Cleaning per -SSPC-SP WJ-4-Light Cleaning Supplemental Spot Cleaning -SSPC-SP 2, Hand Tool Clean and/or SSPC-SP 3, Power Tool Cleaning 	Section A, Part 2.03.B.10 <u>Coating System 3</u> 1 st Ct: Acrylic Primer 2 nd Ct: Acrylic 3 rd Ct: Acrylic	Clean 100% of surfaces to remove all loose coating, loose rust, and other debris. Roughen 100% of I-Beam Arches at East and West Tower Bases.
<u>Timber Stiffening Trusses</u> <ul style="list-style-type: none"> All Wood Surfaces All Attached Metal Elements <ul style="list-style-type: none"> -Railing Braces -Tie Anchor & Rod Assemblies -Metal Face of Trusses Mesh Panel Sections along Sidewalks 	Section A, Part 3.05.D <ul style="list-style-type: none"> Specialized Low Pressure Vapor Blast Cleaning Supplemental Hand and/or Power Sanding 	Section A, 2.03.B.11 <ul style="list-style-type: none"> <u>Coating System 4</u> 1 st Ct: Acrylic Primer 2 nd Ct: Acrylic 3 rd Ct: Acrylic	Clean 100% of wood to remove loose paint and surface debris. Where bare wood is present, completely remove thin surface layer of deteriorated, weathered, wood. Supplement with hand/power sanding as needed to prepare wood as specified. Attached Metal. Remove all loose coating, loose rust, and other loose debris.
<u>Framing Steel (Below Deck)</u> <ul style="list-style-type: none"> PP 0-6, Span 2, West End PP 123-124, Span 2, East End 	Section A, Part 3.05.E <ul style="list-style-type: none"> Spot Power Tool Cleaning -SSPC-SP 15, Commercial Grade Power Tool Cleaning 	Section A, Part 2.03.B.12 <ul style="list-style-type: none"> <u>Coating System 5</u> Spot Ct: Organic Zinc Primer Spot Ct: Acrylic Spot Ct: Acrylic 	Remove all spot areas of rust and deteriorated coating within designated Panel Points. Feather edge intact coating around all spot repair areas.

<u>Lateral Sway Cable Anchorages</u> <ul style="list-style-type: none"> • All Upstream and Downstream Anchorages at Both Ends of Bridge, Including Interior Surfaces and Retrofit at Northeast Anchorage 	Section A, Part 3.05.F. <ul style="list-style-type: none"> • Abrasive Blast Cleaning -SSPC-SP10, Near White Blast Cleaning 	Section A, Part 2.03.B.13 <ul style="list-style-type: none"> • <u>Coating System 6</u> 1st Ct: Organic Zinc Primer 2nd Ct: Epoxy 3rd Ct: Polyurethane 	Abrasive blast clean all steel of all four anchorages
<u>Miscellaneous New Bridge Attachments</u> <ul style="list-style-type: none"> • Vinyl Ester Wear Pads • Galvanized Swivel Couplers • Galvanized Nut/Bolt Assemblies • Other New Shop Primed Steel (i.e. Light Posts, Sole Plates at Bearings) 	See Comments	See Comments	Clean and paint miscellaneous new attachments in accordance with “Repair Item Painting Notes” provided on Plan/Drawing Sheet 47 of 47 “Rehabilitation Coating Details”